

**STRATEGIC AND MARKET ANALYSIS OF
THIRD-PARTY MAINTENANCE OPPORTUNITIES**

**INPUT
LIBRARY**

ABOUT INPUT

THE COMPANY

INPUT provides planning, analysis, and recommendations to executives in the information industries. Through market technology forecasting, analysis, INPUT supports clients in making informed decisions. Services are provided to clients of computers, communications products and services.

The company carries out depth research. Working with clients on important issues, members analyze and integrate data, then develop recommendations to meet innovative ideas to meet clients' needs. Clients receive reports with access to data on which clients can base continuous consulting.

Many of INPUT's professionals have nearly 20 years experience in areas of specialization. Senior management positions in marketing, or planning, enables INPUT to supply solutions to complex business problems.

Formed in 1974, INPUT is a leading international consulting firm. Clients include over 100 of the world's largest and most technically advanced companies.

UNITED STATES, West Coast
2471 East Bayshore Road
Suite 600

Santa Clara 94303

Y-HON
TPM

AUTHOR
Steve Bishop
TITLE
Strategy and Market Analysis of
3rd Party Maintenance Opportunities
LOANED BY
Borrower's Name

Coast
Santa Clara 95051
TPM 07662

1000 Briarwood Street
S.W. 2072

JAPAN

Overseas Data Service Company, Ltd.
Shugetsu Building, No. 12-7 Kita Aoyama
3-Chome Minato-Ku
Tokyo, 107
Japan
(03) 400-7090

000007

STRATEGIC AND MARKET ANALYSIS OF
THIRD-PARTY MAINTENANCE
OPPORTUNITIES

Prepared For:

HONEYWELL, INC.

JULY 1980

INPUT LIBRARY

INPUT

STRATEGIC AND MARKET ANALYSIS OF
THIRD-PARTY MAINTENANCE
OPPORTUNITIES

ABSTRACT

This report contains the results of a survey conducted to determine a third-party maintenance market entry for Honeywell's Building Services Division.

The market areas reviewed and recommended were communications (PABX and satellite ground base systems) and turnkey systems (user site hardware from information processing companies and CAD/CAM).

Market areas covered and not recommended included minicomputers, microcomputers and "office of the future."

Market areas reviewed were selected by matching a profile of the client's area of interest and capability, plus projected market growth rates, profitability and a non-competitive environment as it related to other Honeywell product offerings.

Y-TPM
July 1980

INPUT

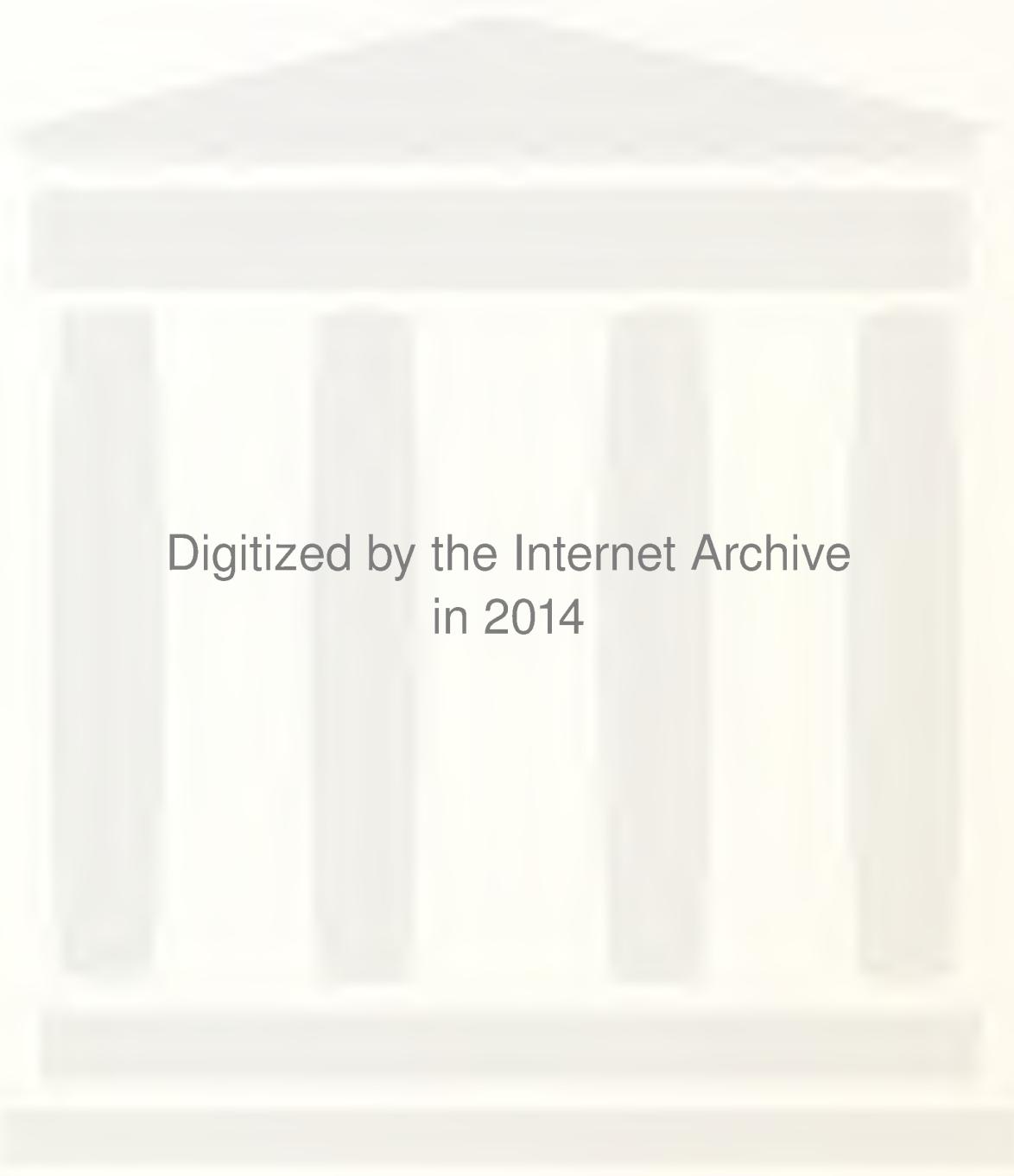
**STRATEGIC AND MARKET ANALYSIS OF
THIRD-PARTY MAINTENANCE
OPPORTUNITIES**

TABLE OF CONTENTS

	<u>Page</u>
I INTRODUCTION	1
II EXECUTIVE SUMMARY	2
A. Overview Of Maintenance	5
I. Background	5
2. Present Trends	6
3. Profile Of The Third-Party Maintenance Market	6
a. Profile Of Management Assistance, Inc.	8
b. Profile Of Pertec Computer Corporation	8
B. Results Of The Study	13
I. The Mini/Micro Market And Honeywell	13
a. The Turnkey Market And Honeywell	13
b. Computer-Aided Design And Manufacturing	
Market And Honeywell	16
2. The Communication Market And Honeywell	18
3. The Office-Of-The-Future Market And Honeywell	24
4. The Interconnect Market And Honeywell	26
C. TPM Market Entry	28
III COMMUNICATIONS	31
A. Current Data Communications Facilities	31
I. Overview	31
2. Traditional And Contemporary Data Communications	
Services	38
3. Digital Services	44
4. Packet Switching	45
5. Satellite Services	49
6. The Communications Market And Honeywell	54
7. Summary Of Available Services	57
8. Interconnect	57
9. The Interconnect Market And Honeywell	63
IV TURNKEY SYSTEMS	67
A. Definition	
B. Market Status And Trends	67
C. Market Size And Growth	71

	<u>Page</u>
D. Driving And Retarding Market Forces	75
E. Maintenance	83
F. The Turnkey Market And Honeywell	85
 V COMPUTER-AIDED DESIGN AND MANUFACTURING	87
A. Definition 87	87
B. Current Status And Trends	88
C. Forecasted Market Growth	91
D. Driving And Retarding Forces	91
E. Maintenance And Services	93
F. The CAD/CAM Market And Honeywell	93
 VI OFFICE OF THE FUTURE	95
A. Characteristics Of The Office Automation Market	95
B. Current Market Status And Trends	99
1. Electronic Mail Services	99
2. Source Document Microfilming And COM	102
3. Information Retrieval Systems	103
4. Optical Character Recognition Service	103
5. Correspondence Control Systems	104
6. Data Base Services	105
7. Word Processors	105
8. Photocomposition And Phototypesetting	109
C. Vendors Of Office Automation Equipment	110
D. Maintenance And Service	121
E. The Office-Of-The Future Market And Honeywell	121
 VII MAINTENANCE IN THE DATA PROCESSING INDUSTRY	123
A. Service Is A Business	123
1. Historical Perspective And Driving Forces	125
2. The Opportunity	127
B. Implications Of Managing Field Service As A Business	128
1. Revenue Treatment	129
2. Return On Asset Performance Measurement	129
3. Organization	130
4. Productivity	130
5. Marketing And Sales	131
C. Contract Trends	133
D. Personnel Considerations	134
1. Salary And Incentives	135
2. Sources Of Personnel	135
3. Serviceperson-Of-The-Future Trends	137
a. Local Field Service Technician (LFST)	137
b. Local Field Support Specialist (LFSS)	138
c. Central Site Support Specialist (CSSS)	139
E. Third-Party Maintenance (TPM)	139

	<u>Page</u>
VIII RESPONDENTS' COMMENTS	143
A. Interconnect	143
I. Respondents' Comments On Interconnect	145
B. Communication	150
I. Respondents' Comments On Communications	151
C. Respondents' Comments On Office Equipment Market	157
I. Respondents' Comments	158
D. Respondents' Comments On Turnkey Systems	163
I. Respondents' Comments	163
E. Respondents' Comments On Micro/Minicomputer Market	166
I. Respondents' Comments	166
F. Respondents	168



Digitized by the Internet Archive
in 2014

<https://archive.org/details/03348YHONxx80Strategicand>

**STRATEGIC AND MARKET ANALYSIS OF
THIRD-PARTY MAINTENANCE
OPPORTUNITIES**

LIST OF EXHIBITS

		<u>Page</u>
II	-1 1979 Maintenance Revenues By Field Engineer And Vendor Type	9
	-2 1979 Average Profit-Loss For Maintenance By Vendor Type	10
	-3 Maintenance Revenues For Turnkey Systems Provided By Processing Service Companies, 1979-1984	15
	-4 CAD/CAM Market Revenue Projections, 1978-1984	17
	-5 CAD/CAM Maintenance Market Projections	19
	-6 Satellite Ground Station Growth	21
	-7 Satellite Ground Station Maintenance Growth	22
	-8 Forecasted Hardware And Maintenance Revenue For The Private Interconnect Market	27
III	-1 Major Suppliers Of Communications Services	32
	-2 Percent Of Data Message Traffic Carried On Private Lines	39
	-3 Summary Of Current Communications Services	58
	-4 Increase In Private Interconnect Telephones Installation, U.S. Only	61
	-5 Forecasted Hardware And Maintenance Revenue For The Private Interconnect Market	62
IV	-1 Market Forecast For Turnkey Systems By System Component, 1979-1984	72
	-2 Market Forecast For Turnkey Systems By Vendor Type, 1979-1984	74
	-3 Market Growth In Turnkey Systems, 1978-1984	80
	-4 Market Forecast By Component, 1978-1984	81
	-5 Ratings Of Money-Making Factors In Turnkey Systems	82
V	-1 CAD/CAM Market Share By Company	89
	-2 CAD/CAM Market Shares By Application For 1979	90
VI	-1 Acceptance Of Multifunction Systems And Services (By System)	119

		<u>Page</u>
VII	-1 Total User System Expenditures Over A Seven-Year Life Cycle	124
	-2 User Cost Distribution Of Typical IBM 8100 Information Systems	126
	-3 Ratings Of Primary Sources Of New FS Personnel	136

I INTRODUCTION

I INTRODUCTION

- This report is the culmination of Phase II of the custom study, "Strategic and Market Analysis of Third-Party Maintenance Opportunities," performed by INPUT for Honeywell Building Service Division.
- The result of Phase I of this study was an agreement to examine the third-party maintenance (TPM) opportunities for Honeywell with OEM vendors.
- OEM opportunities were defined as those situations in which a manufacturer or system integrator would designate Honeywell as the third-party maintenance service vendor for a certain product. Honeywell would provide a packaged, full-service offering that would cover both hardware and systems software on business or minicomputer systems whose purchase price was less than \$200,000.
 - For that equipment or system leased by the end user, the manufacturer or system integrator would designate Honeywell as the authorized maintenance vendor. Honeywell would perform these maintenance services under contract with the equipment or system supplier.
 - For that equipment or system purchased by the end user, the manufacturer or system integrator would designate Honeywell as the authorized maintenance vendor.

- . During the warranty period, services would be performed under contract between Honeywell and the equipment or system supplier.
 - . Once purchased equipment was out of warranty, Honeywell would supply maintenance services under direct contract with the end user. This might or might not be the same equipment or system for which Honeywell provided warranty or lease maintenance services under contractual agreement with the manufacturer or systems integrator.
- Applications software would be included only when it was to be supplied by the vendor, and was not modified by the user.
- At a subsequent meeting in Minneapolis, the markets to be studied were limited to:
 - Mini/microcomputers.
 - Communications.
 - Office of the future.
- The basic mission was to project a market for Honeywell as a TPM supplier under the conditions that:
 - Honeywell could generate an additional \$50 million in revenue within five years after market entry.
 - A 20-25% operating profit could be generated.
 - There would be a 25% AAGR (average annual growth rate).

- The product need not bear a Honeywell logo.
- The target market fit the "service orientation of BSD," and the overview area of interest was "in OEM service for systems and subsystems that improve people productivity."

- Although the investment level for market entry was open, a \$10 million to \$20 million requirement was considered reasonable.
- Further restrictions relating to the market for Honeywell TPM stipulated that:
 - Companies selected must not be considered competitors of Honeywell.
 - The addition of Honeywell service would not create a competitor.

II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

A. OVERVIEW OF MAINTENANCE

I. BACKGROUND

- The information processing industry has spoiled its users with prompt, inexpensive maintenance.
 - This dates back to the pre-1956 IBM consent decree wherein IBM was forced to offer equipment for sale (as well as for lease or rent) to the end user. Maintenance was consequently unbundled as a separate, chargeable item.
- For years IBM chose to derive its income from equipment rental or sale, treating maintenance and related services as a cost of doing business.
- In the early 1960s, IBM separated field engineering from sales. This move initiated its evolution from a cost center into a profit-making division.
 - In 1979, IBM achieved new price/performance records for hardware. Revenue that was lost in the new equipment announcements was to be made up, in part, by increased maintenance revenues.

2. PRESENT TRENDS

- Until recently, vendors had generally perceived that annual maintenance charges pegged at 12% of the purchase price were marginally acceptable to users, while charges of 15% or more were out of the question.
 - Nevertheless, IBM has aggressively priced the annual maintenance cost of a large configuration of the 8100 at 25%, and a small configuration at 22% of the purchase price.
- Software maintenance has also become a major revenue producer.
 - On 8100 software, maintenance represents 15% of the purchase price on a large system and 27% on a small system.
- Further unbundling of services can be expected as IBM and other firms seek additional revenue streams to compensate for the erosion of hardware prices by technological advances.
- Until the newer devices become widely installed and the revenues start flowing, maintenance for most firms will be only modestly profitable.
 - Projections place the current \$6.8 billion maintenance market at an approximate 14-15% pre-tax profit level.
 - Maintenance profitability will increase to a level of 19-21% by 1983, due to the advent of labor-saving techniques (such as remote diagnostics and systems support centers), increased maintenance prices, and additional unbundling of services.

3. PROFILE OF THE THIRD-PARTY MAINTENANCE MARKET

- TPM organizations in data processing came into being in 1963 with the growth of leasing companies which purchased new or depreciated equipment and leased it back to users.

- TPM maintenance rates were set lower than the rates charged by the original manufacturers. Hence, they further contracted an initially modest profit margin.
- The TPM business has evolved into two distinct areas:
 - The end user market: typically serviced by firms that maintain all types of devices. These firms solicit business from both leasing companies and end users that have purchased equipment.
 - . This is considered a short-life market with small profit margins.
 - The OEM market: a situation in which the manufacturer turns all of its service over to a TPM firm.
 - . This type of business is on the upswing because it provides a wider market for the manufacturer and higher profit margins for the TPM.
- The market sizing of TPMs is somewhat unique:
 - There are large firms (\$50 million in maintenance revenue) such as Sorbus, TRW and CDC (COMMA).
 - There are hundreds of small firms (less than \$1 million) such as Indeserve, local distributors of office equipment, and local franchise operations (Byte Shops, Computerland).
 - But there are very few mid-range companies (\$10-50 million) such as Pertec.
- With the exception of COMMA (CDC), all large and mid-range TPM firms service the products produced by the parent company.

- CDC's COMMA is scheduled to be folded into the field engineering groups for standard products within three years.
- Revenues and profits derived from DP maintenance are not up to the present expectations of Honeywell, as Exhibits II-1 and II-2 illustrate.
 - a. Profile Of Management Assistance, Inc.
 - MAI produces small business computers (Basic Four), word processors and terminals, and provides TPM via Sorbus.
 - In 1979, MAI reported sales of \$271 million and a profit from operations of \$42.6 million, or 16%.
 - Maintenance and related services for the same period gathered \$78 million in revenue with \$9.5 million in operating profit, or 22.3%.
 - Field engineering consists of 1,450 U.S. employees in 160 locations, of which 930 were field service personnel. In addition, there are 450 field service personnel in 69 locations overseas.
 - Revenue for the total maintenance force is \$39,000 per person. Revenue for field engineers alone is \$56,000 per person.
 - MAI services 80,000 units consisting of more than 3,000 types of equipment used by over 10,000 customers.
 - Forty-two percent of the revenue is derived from servicing equipment manufactured by IBM, 30% is derived from servicing equipment manufactured by MAI, and 28% is derived from servicing equipment manufactured by others.
 - b. Profile Of Pertec Computer Corporation
 - Pertec markets and services equipment and systems within the general-purpose minicomputer and microcomputer market.

EXHIBIT II-1

1979 MAINTENANCE REVENUES
BY FIELD ENGINEER AND VENDOR TYPE

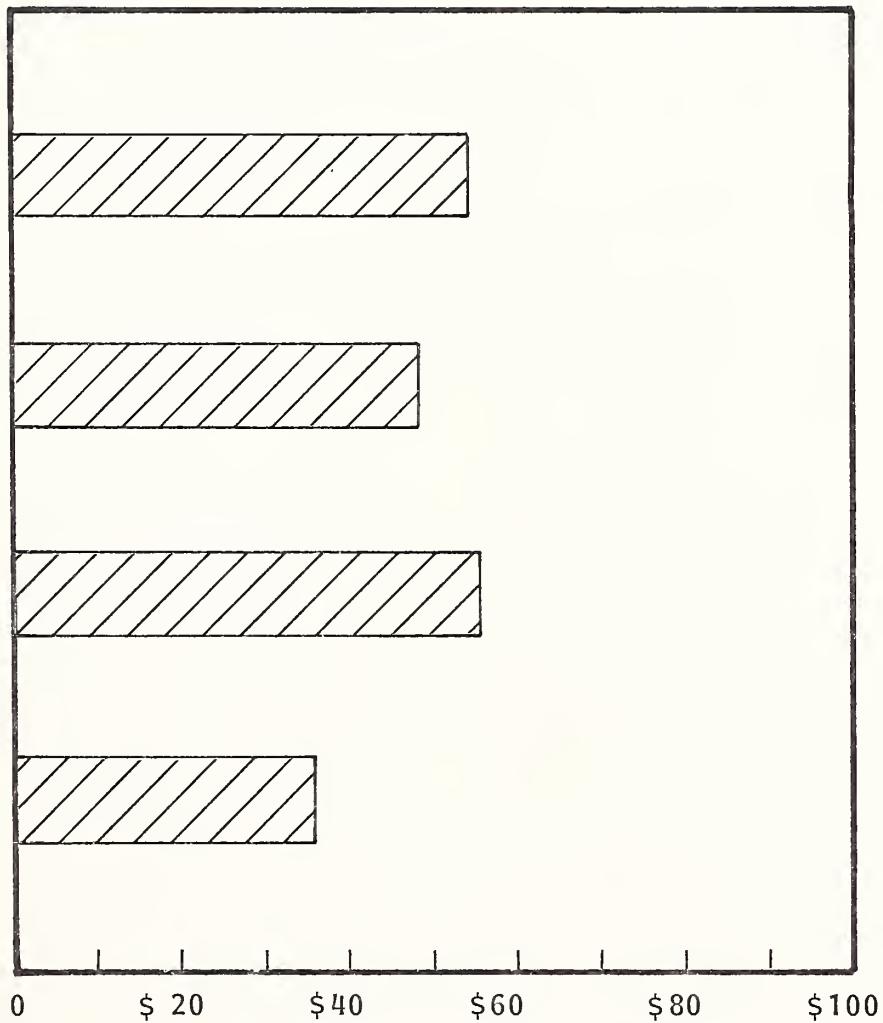
TYPE OF VENDOR

ALL D.P.
(MAINFRAMES,
SMALL BUSINESS
COMPUTERS, MINI-
COMPUTERS, PER-
IPHERALS, TER-
MINALS, OTHERS)

TPM

MAI
(SORBUS)

PERTEC



\$ THOUSAND PER FIELD ENGINEER

EXHIBIT II-2

1979 AVERAGE PROFIT-LOSS FOR MAINTENANCE
BY VENDOR TYPE

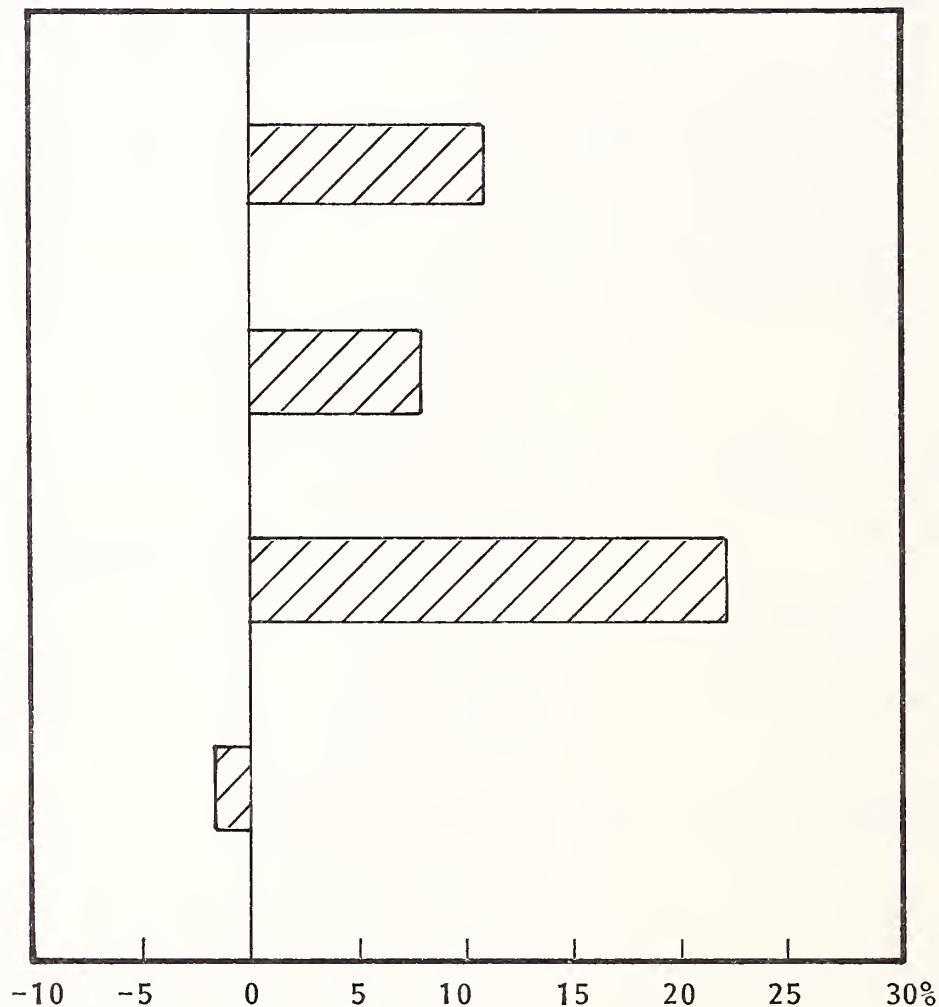
TYPE OF VENDOR

ALL D.P.

TPM

MAI (SORBUS)

PERTEC



PROFIT/LOSS AS A PERCENT OF MAINTENANCE REVENUES

- In 1979, the company reported \$134 million in revenue with an operating income of \$24.4 million, or 18%.
- In 1977, the company entered the TPM market and reported \$8 million in revenue with a \$2.7 million loss. This was followed in 1978 with \$11.9 million in revenue and a \$278,000 loss, and in 1979 with \$15.7 million in revenue and a \$196,000 loss.
 - The maintenance/service force is comprised of 622 people, of which 432 are field engineers. Revenues in 1979 for the entire division equalled \$25,000 per person, \$36,000 per field engineer.
- While it is difficult to differentiate true from divisional profit in an integrated firm (accounting practices can make any division look good or bad), it does appear that there is an economy of scale in TPM; i.e., the larger the revenue base, the greater the profit.
- The trend for maintenance pricing in the data processing industry is set by IBM.
 - IBM established the Field Engineering Division in 1964, removing the field engineering function from sales, and establishing it as a profit center.
 - Since this change, IBM has continued to increase maintenance prices and profits.
 - In 1979, further unbundling took place with the 8100 announcement. Thus a trend was established to drive hardware prices down and to derive profit instead from hardware and software maintenance.

- IBM dominates the data processing business as AT&T dominates the communications industry.
 - Neither company wishes to unbundle services from hardware, but both have been forced to do so by government action.
 - With more of its "monopoly umbrella" stripped away, AT&T (like IBM) is fighting back with aggressive pricing and new services.
 - Vendors perceive that they must price their products and services 15-20% below these two companies in order to create a niche in the market.
 - Pricing based upon competition, rather than on services rendered, has created a situation in which manufacturers as well as TPMs derive only marginal profits from products and services.
- Therefore, in addition to the ground rules established by Honeywell for entering the TPM market, three more directions have been included.
 - Find a product to support in a market not dominated by IBM or AT&T.
 - Find a product where the value added through services rendered facilitates a break with the traditional comparative method of pricing maintenance as a percent of the purchase price.
 - Find a market or application in which:
 - . No one vendor supplies all of the required pieces to meet the users' requirements.
 - . One-source maintenance is a critical factor in the users' perceptions.

B. RESULTS OF THE STUDY

- In the course of preparing this study, the very large, generic topic of "third-party maintenance" was systematically limited in scope to include only those market sectors which fit the selection criteria stated above.

I. THE MINI/MICRO MARKET AND HONEYWELL

- There were only two areas of this market sector which met the selection criteria: turnkey systems and CAD/CAM. The other areas were discarded for the reasons indicated below:

- Micros as a TPM market could not meet the established application of profitability even in its broadest sense.
 - . Service is provided by distributors who sell and maintain the equipment.
 - . The low purchase price precludes a significant dollar flow from maintenance contracts. Contracts are written for 10-15% of a purchase price under \$15,000.
 - . TPM firms that are making money on micro maintenance are estimated to be producing a 7-8% pre-tax profit, which is far below the selection criteria.
- Minis (except for the two areas noted) were discarded, as they threaten to compete with HIS or Control Systems.

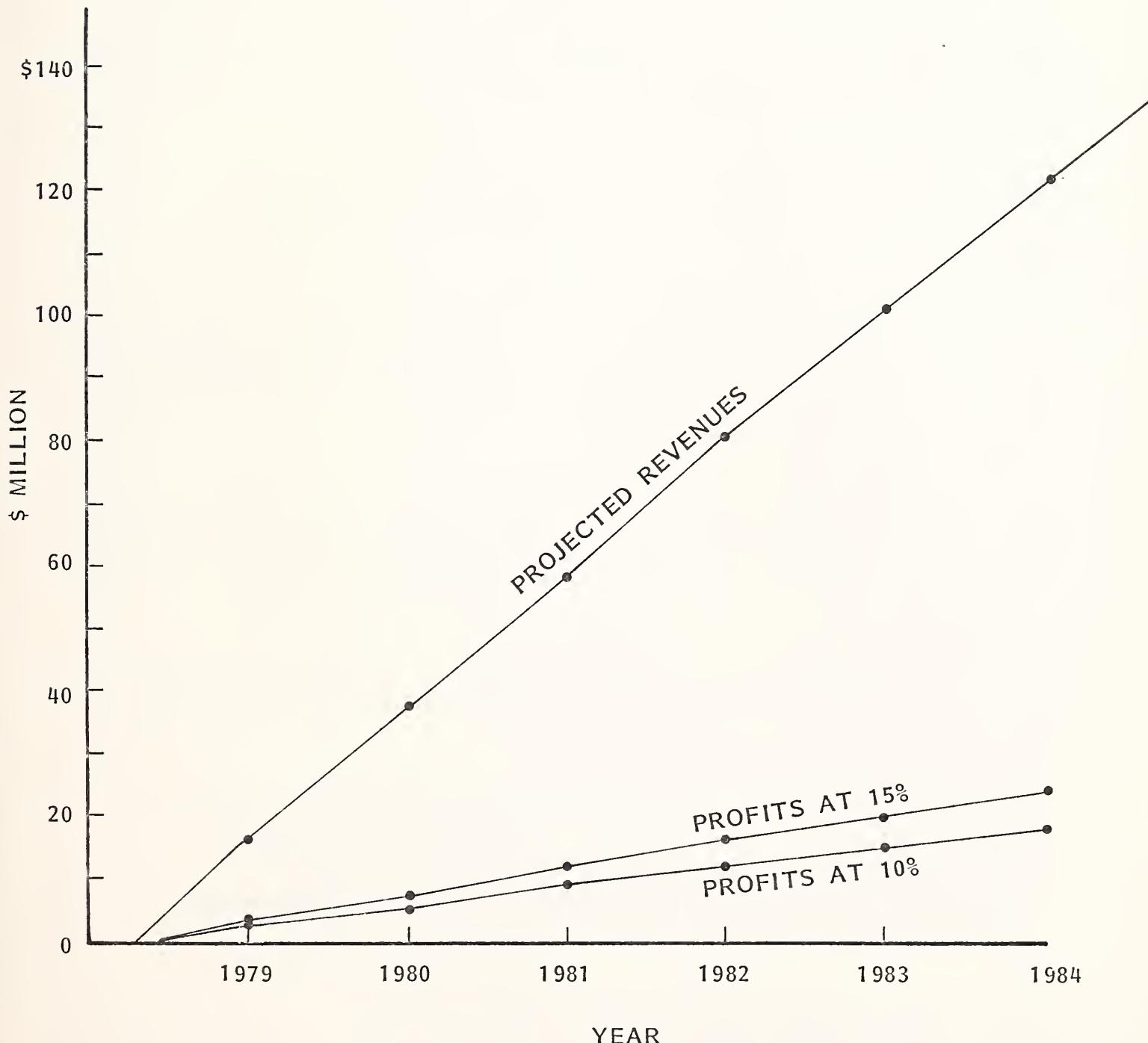
a. The Turnkey Market And Honeywell

- A turnkey system is defined as a "package" of software and hardware that is intended to fulfill a user's specific application requirements.

- Turnkey systems are provided from a number of sources, such as hardware manufacturers and system houses.
 - The most recent type of vendor to enter this market is the information processing company providing on-site user hardware which is either compatible with its processing service computer or usable as an extension of its software packages.
- The user on-site hardware supplied by services companies provides a market for Honeywell OEM-TPM.
- This market meets all of the established selection criteria. Furthermore, it has an estimated growth rate of 125% AAGR through 1984.
 - The maintenance revenue for this sector is projected to grow from \$16 million in 1979 to \$122 million in 1984, with profits in the range of 15-20%, as shown in Exhibit II-3.
 - Presently, only 14% of the hardware maintenance and 5% of the software maintenance is provided by TPM.
 - It is a new market area with few established patterns for marketing and service.
- These information processing companies need to:
 - Stay abreast of this new market trend.
 - Provide on-site hardware in concert with the geographic distribution of users' present and planned communication facilities.
 - Provide user training as well as field maintenance.
 - Retain a profitable operation while building a field service organization which, with a few exceptions, is not now in existence.

EXHIBIT II-3

MAINTENANCE REVENUES FOR TURNKEY SYSTEMS PROVIDED
BY PROCESSING SERVICE COMPANIES, 1979-1984

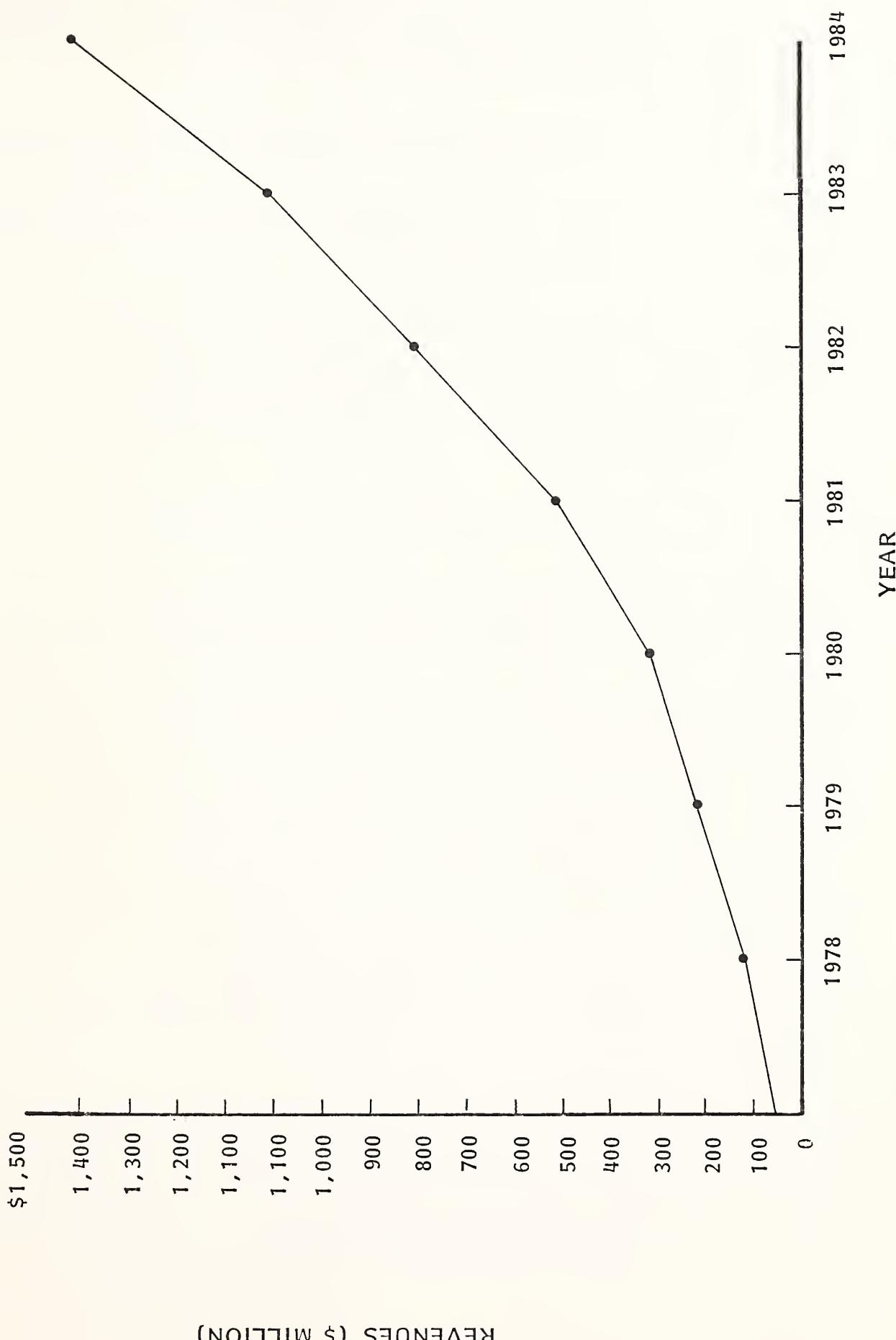


- This market is not dominated by any one processing services firm. The larger companies that are (or soon will be) in this business sector include: Tymshare, NCSS, MCAUTO, Boeing Computer Services and ADP.
- INPUT recommends the maintenance and service of on-site user hardware for information processing firms as a method of entry into the OEM-TPM market.

b. Computer-Aided Design And Manufacturing Market And Honeywell

- CAD (computer-aided design) and CAM (computer-aided manufacturing) may be defined or described as:
 - A system that combines human skill, expertise and intuition with the speed and accuracy of a computer. (CAD or CAM)
 - A system allowing an engineer or a designer to create and modify designs on a CRT screen interactively with the assistance of a computer, thereby increasing productivity during the design phase of production. (CAD)
 - A system designed to increase the productivity of the manufacturing process by allowing engineers to produce numerical control tapes for operating machine tools and assembly devices. (CAM)
- CAD/CAM systems are particularly useful in designing mechanical parts and systems, electronic systems, integrated circuits and printed circuit boards.
- The CAD/CAM market (a subset of the turnkey system market) meets all of the selection criteria for an OEM-TPM situation for Honeywell.
- The market presently consists of six small vendor companies; however, larger firms can be expected to enter this area.
- The market is projected to grow from \$275 million in 1979, to \$1.5 billion in 1984, as shown in Exhibit II-4.

EXHIBIT II-4
CAD/CAM MARKET REVENUE PROJECTIONS, 1978-1984



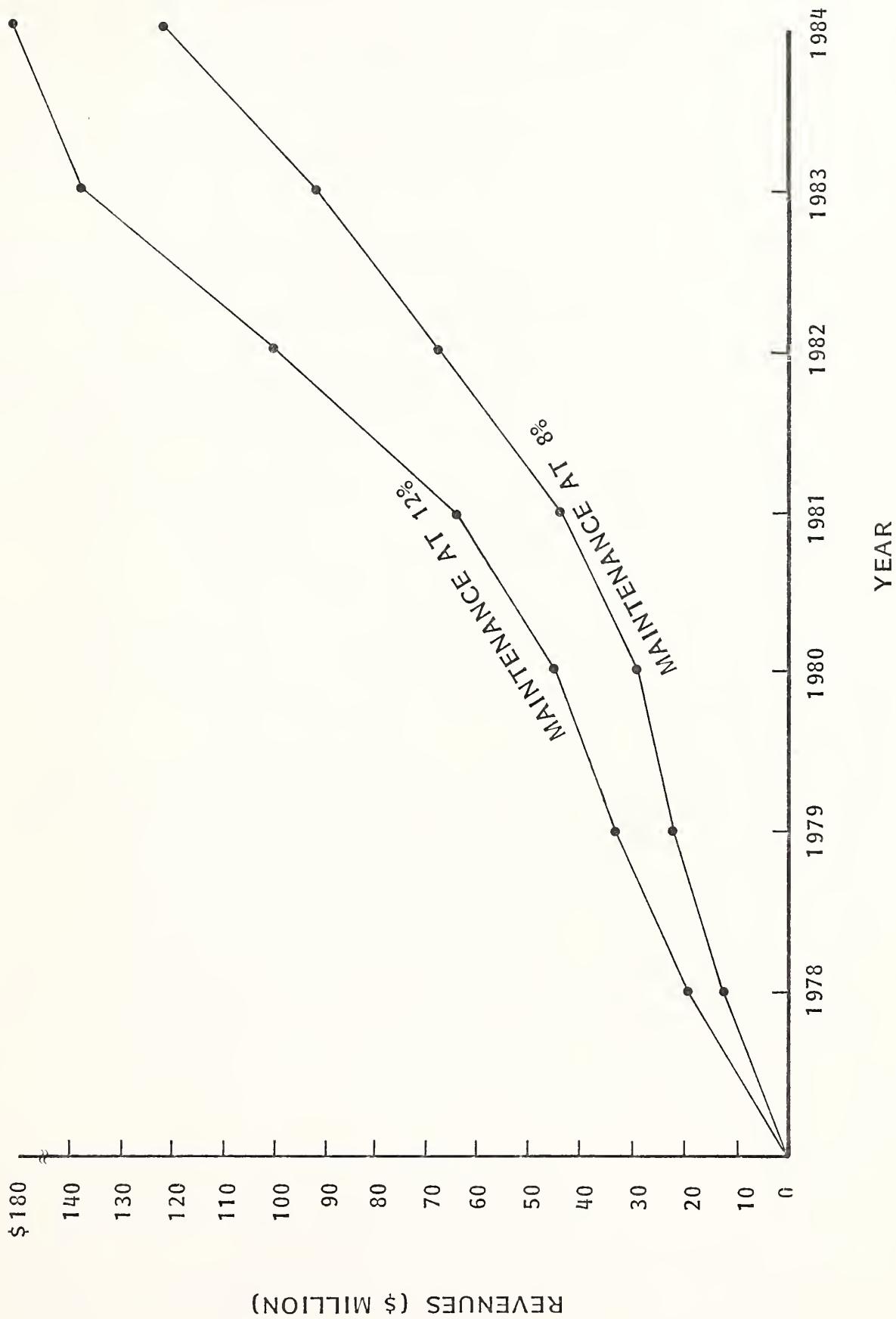
- By 1984, the maintenance/service portion of this market is projected to reach \$225-300 million, from a 1979 estimated base of \$82-133 million, as shown in Exhibit II-5.
 - The market growth is restrained by a lack of field engineers.
- INPUT recommends CAD/CAM as an emerging market in need of competent field maintenance and service.
 - Due to the technical complexities of the equipment and software configuration, combined with vendors' desires to keep software confidential, there has been very little OEM-TPM penetration of this market sector.

2. THE COMMUNICATION MARKET AND HONEYWELL

- The area of satellite communications, and specifically ground-based stations, has been selected as a potential market for Honeywell OEM-TPM.
- This market meets all of the established selection criteria, with three qualifications:
 - The sector of CATV and hotel/motel is a new and rapidly growing market. As such, it is lacking in history as to profitability.
 - The need for local maintenance is questionable as the units are stated to have high reliability (again there is no track record to prove or disprove this) and can be fixed by the user by swapping parts.
 - The manufacturers do not wish to provide maintenance and to date have done so only in special situations. The vendors, hard pressed to keep up with the order demand, have not been forced to provide service to sell the product; hence a true service market has not been established except by users.

EXHIBIT II-5

CAD/CAM MAINTENANCE MARKET PROJECTIONS



- A ground-based station is defined as the required terminator equipment (i.e., antenna and electronics) required to transfer signals from the ground site and/or to receive signals from a target satellite.
- The ground-based station market is sectored by size (i.e., diameter of the antenna disk) into:
 - Very large systems (antennae of more than 10 meters), each with a cost in excess of \$10 million dollars.
 - . These systems are complete turnkey operations and are marketed to U.S. and foreign governments.
 - Medium-to-large systems (antennae of 5-7 meters), with prices ranging from \$250,000 to more than \$1 million.
 - . These systems are sold to common carriers such as AT&T, RCA and Western Union as well as specialized carriers like MCI and SBS.
 - . While these systems are purchased from an antenna manufacturer, a mixture of equipment from many sources is generally required to achieve a complete ground station. (As an example, the earth stations for SBS are assembled by Hughes Aircraft using its own radio frequency terminals plus time division access modems from Fujitsu, satellite communications controllers from IBM and port adaptor systems from Nippon Electric.)
 - . Exhibits II-6 and II-7 illustrate INPUT's projections that there will be approximately 100 medium-to-large ground stations employing 1,500 field engineers by the end of 1980, with a purchase value of \$40 million. By the end of 1985, projections indicate that there will be 800 earth stations of this size employing 8,000 field engineers, with a purchase value of \$320 million.

EXHIBIT II-6

SATELLITE GROUND STATION GROWTH

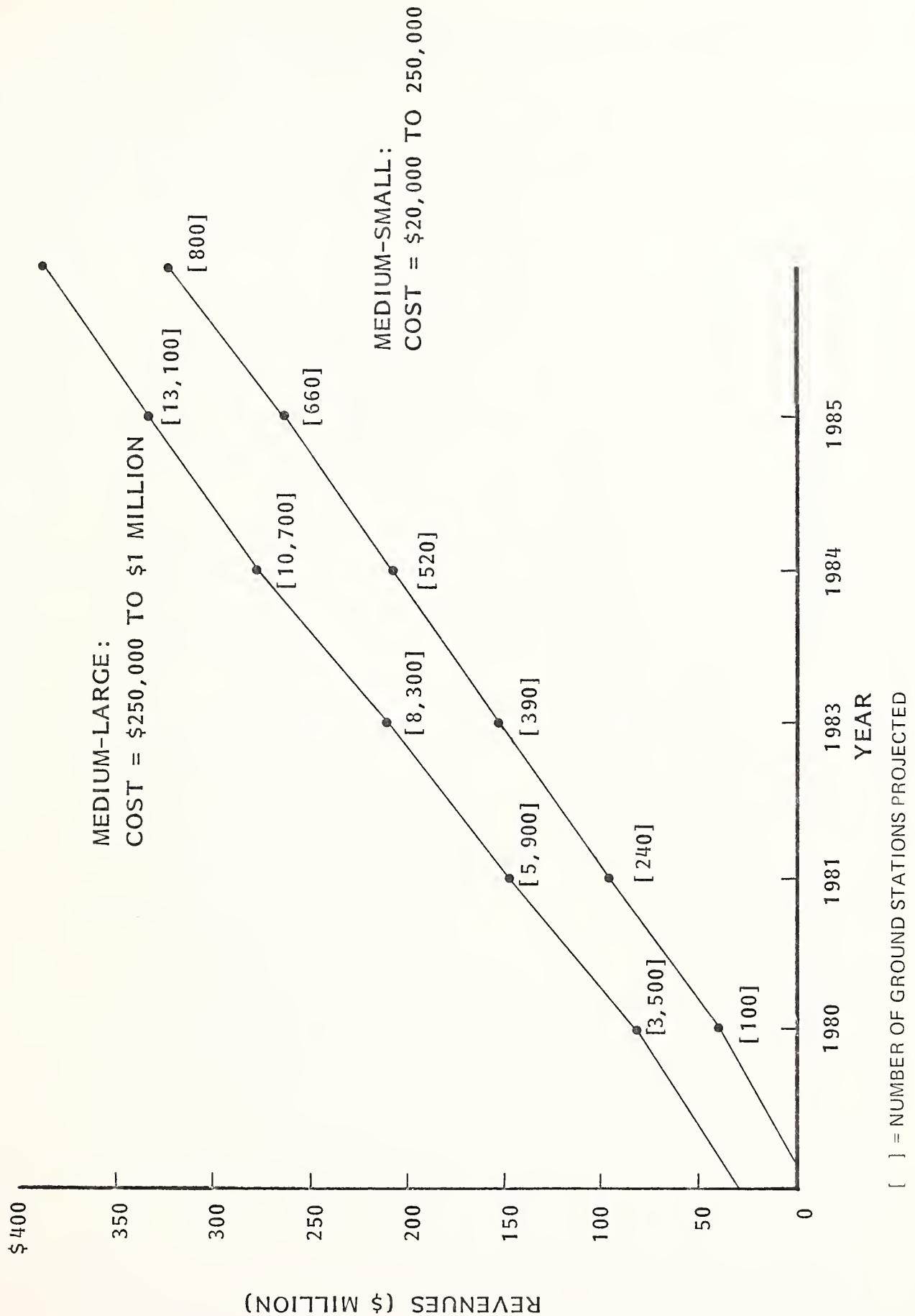
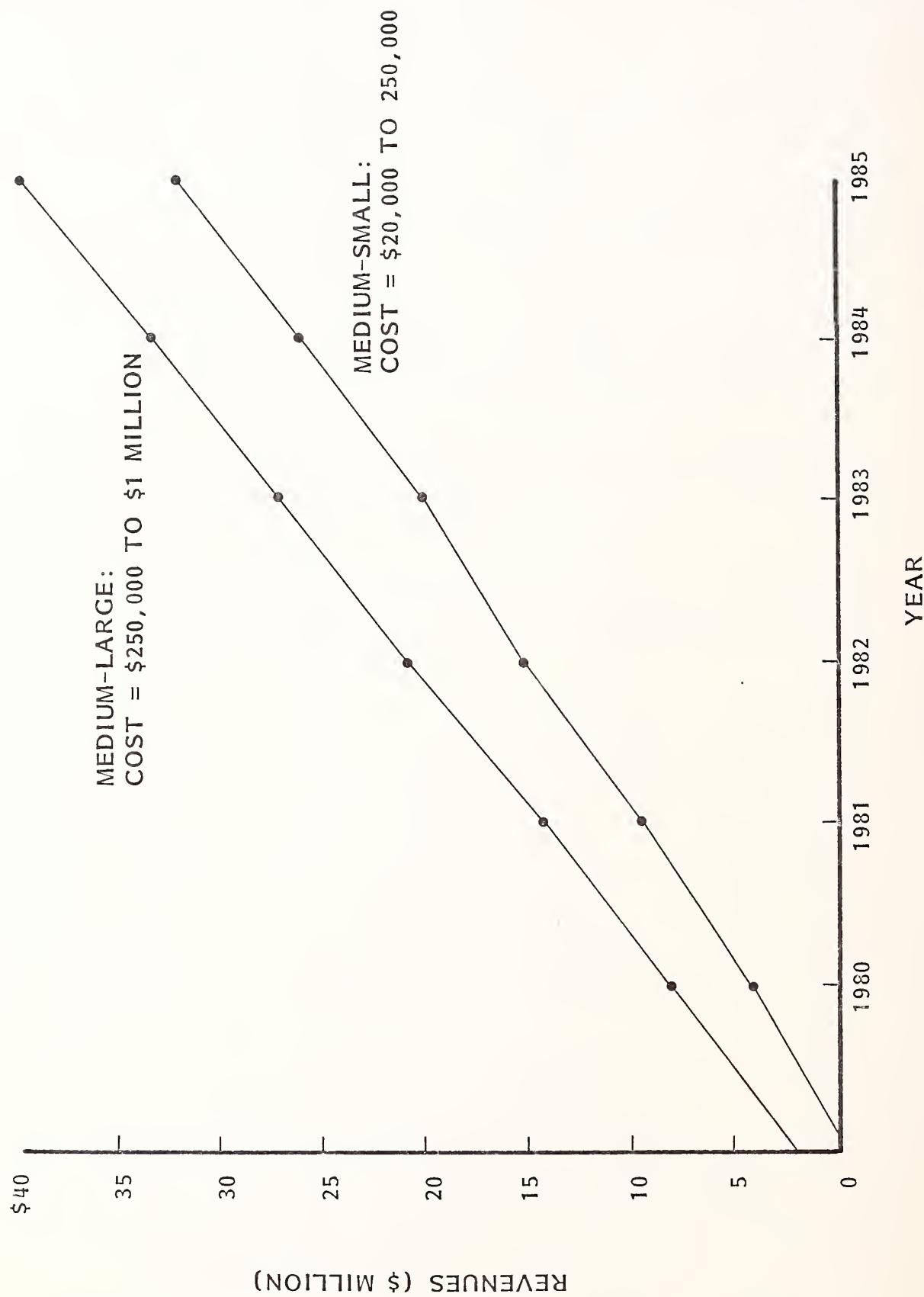


EXHIBIT II-7

SATELLITE GROUND STATION MAINTENANCE GROWTH



- Medium-to-small systems (antennae of 3-5 meters), with prices ranging from \$20,000-250,000.
 - . These systems are used by CATV, which is perceived by the vendors as the most rapidly growing segment of the ground-based station market.
 - . In 1979, there were 3,000 CATVs in operation, with earth stations valued at \$60-105 million. It is estimated that by 1985 there will be 12,000 earth stations installed with CATVs (some of which will have two systems for different satellites) valued at \$240-420 million.
 - . Another significant market, the hotel and motel industry, is emerging for this class of earth station. Holiday Inn has a total of 125 stations installed or on order from Scientific Atlanta and Microdyne, and projects growing to 1,400 by 1983.
- The market for hotels/motels is projected to reach 3,500 stations by 1985, with a purchase value of \$70 million.
 - This market is based on small systems (antennae of less than 3 meters) with prices under \$20,000 or monthly rental fees of \$25-35, excluding satellite service.
 - . These ground stations are slated for home and apartment house installation. COMSAT and Sears have just broken off discussions for entry into this market.
 - . The mass market for home systems is vulnerable to CATV, which will provide equal service for less money.
- U.S. companies in the antenna business include Scientific Atlanta, Harris, Comtech Labs, Ford Aerospace, Microdyne, M/A Communications, California Microwave, TRW and Hughes.

- The size of the antenna required is determined by the geographic location of the earth station as it relates to the "footprint" of the satellite, the amount of local interference from nearby radiating antennae, the height of the satellite or device to be tracked, and the quality desired of the receive/transmit signal.
 - There are companies such as Comsearch, Compucon and Spectrum Planning that provide services to determine the size of the antenna disk and other related criteria for a specific installation.
- The increase in the number of ground-based stations has given rise to distribution vendors (some of which were in the radio and TV tower business) such as Fort Worth Tower, U.S. Tower, Servision, WICI, Gardner Enterprises and STS.
- INPUT recommends that Honeywell explore this market and further evaluate entering via:
 - OEM-TPM for the CATV, hotel/motel sector in concert with a manufacturer of 3-7 meter antennae.
 - Joining a consortium (i.e., Johns-Manville, Hughes, Southern Pacific or Metropolitan Life) in launching a satellite.

3. THE OFFICE-OF-THE-FUTURE MARKET AND HONEYWELL

- The office is defined as a place where managerial and administrative personnel interact with the other groups that form a company. The "office of the future" is a concept relating to the potential, beneficial impacts of future technology on a company's internal interaction and productivity.
- The office of the future objectives are to:
 - Increase managerial effectiveness.
 - Increase white-collar worker productivity.

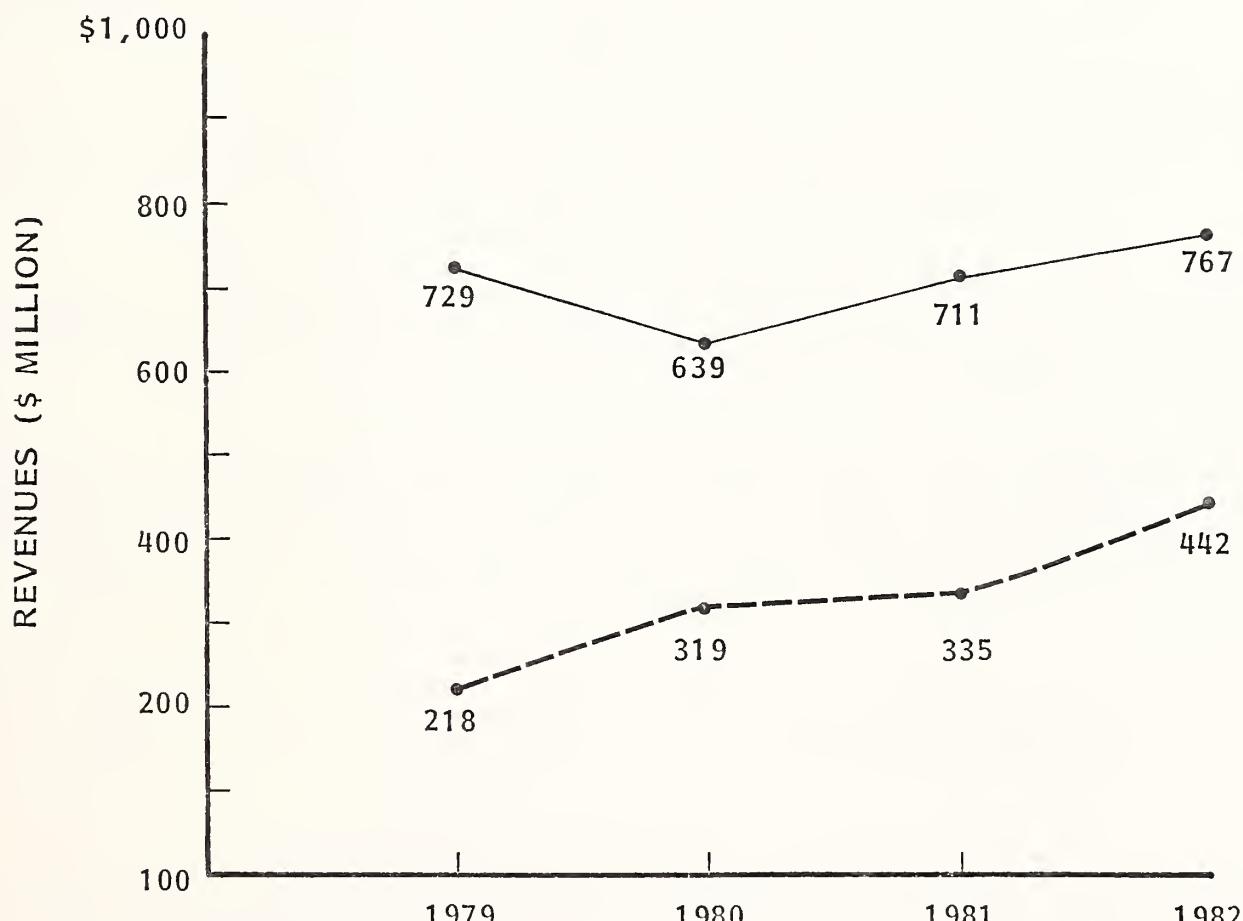
- Reduce office costs.
 - Reduce the volume of paper handled and stored.
- A totally integrated system for the rapid electronic flow of information is required to realize those objectives. The technology currently applied to processing information will be applied to communicating information.
 - Computers, office automation and communications are combined to form the integrated system.
 - Flexible transmission networks to interconnect the subsystems are vital to this integration.
- The "office of the future" as a TPM does not offer an obvious market for Honeywell.
 - The market is dominated by IBM, Xerox and Exxon, which control over 70% of the market and do not need or use TPM.
- The market is growing at an extremely rapid rate; however, a clear-cut contender has yet to surface to offer either a challenge to the big three or a TPM opportunity for Honeywell.
- Companies that provide TPM in this market are doing so at less than 15% pre-tax profit (and in several cases are incurring losses).
- Due both to the domination of this market by three large firms and to marginal profits, INPUT recommends that Honeywell not consider this market as an OEM-TPM opportunity.

4. THE INTERCONNECT MARKET AND HONEYWELL

- The interconnect market is loosely defined as PBX (private branch exchange) and associated telephones supplied by a non-telco operating company. The interconnect is "on the wall" in front of the PBX.
- This market meets all of the selection criteria established by Honeywell except that:
 - Maintenance profitability is unknown, but is estimated in the 15-20% range.
 - The market is cluttered with small area distributors providing sales and service.
 - This market sector lacks a definite leader offering an obvious OEM-TPM possibility.
 - The annual sales rate is slowing, as shown in Exhibit II-8.
- Market entry approaches for Honeywell include:
 - Direct contact with manufacturers such as Okidata, Hitachi, Siemens, Nippon Electric, etc.
 - . While the method for selling the product has been through distribution, the market is changing and so must the distribution channels.
 - . IBM will soon enter the domestic market with the 3750 PABX, which has been offered in Europe and Canada.
 - . AT&T is rumored to be readying a PABX for sale in its new, nonregulated business groups.

EXHIBIT II-8

FORECASTED HARDWARE AND MAINTENANCE REVENUE FOR
THE PRIVATE INTERCONNECT MARKET



HARDWARE REVENUE = _____
MAINTENANCE REVENUE = _____

- The PABX will be a key element in the "office of the future."
- The vendors and distributors realize that they will no longer have a viable product or market when IBM and AT&T decide to slant PABX towards the electronic office.
- In order to provide a market entry base, Honeywell could acquire local distributors who, because of the 1980 sales slumps and the evolving nature of the market, are anxious to sell.
 - However, this approach would place Honeywell in a position of a distributor handling both sales and service.
 - The hardware vendors would welcome a large firm as a distributor, as it would ease their market and product transition.
 - The distributorships are nonexclusive and as such are available nationwide.
- INPUT would recommend this marketplace to Honeywell as a method for entering the "office of the future," but not for short-term, OEM-TPM profitable revenue.

C. TPM MARKET ENTRY

- There are several factors that will retard the entry of Honeywell (or anyone else) into the TPM market. Any of the areas selected by INPUT as desirable will have some or all of the following drawbacks:
 - Manufacturers fear a conflict of interest generated by a TPM division that is part of a company in the same industry, whether or not they are direct competitors.

- TPM firms do not have a good image in the industry from a user's or manufacturer's viewpoint.
- Entrenched field engineering managers do not wish to see their empire taken away.
- The manufacturers' corporate management perceives that theirs is a unique, complex device that only their own people can maintain.
- Management has come to realize that maintenance can and should be profitable.
- Management understands that proper maintenance of hardware and software is the key to user acceptance and repeat business.
- Regardless of how bleak the situation is now, management believes they can see the "light at the end of the tunnel" with more reliable equipment, remote diagnostics and systems support centers.

- Even if these objections are not specifically raised, the drawbacks remain. Any marketing effort to enter the OEM-TPM field must be structured to handle these problems (be they real or imagined).
- Honeywell BSD can bring several positive points into this market that are powerful sales tools, including:
 - No conflict with data processing or communications vendors.
 - National coverage.
 - Reputation.
 - The ability to pull together industry knowledge from a very diverse corporation.
 - A large training capability.

- Access to people in other divisions that can produce multiple skill levels.
- The capability to provide depots and warehouses.
- Cash and people to stock an adequate supply of spare parts.
- Cash and people to provide repair centers for boards and units rather than having them returned to the plant.
- The capability to purchase the present field engineering force, grow it, train it and sell it back to the manufacturers.
- Local customer support in spite of the advent of remote diagnostics and system support centers.
- Capable, bright management.

- Honeywell has the ingredients for success in the OEM-TPM business.

III COMMUNICATIONS

III COMMUNICATIONS

A. CURRENT DATA COMMUNICATIONS FACILITIES

I. OVERVIEW

- The communications industry offers an unsurpassed area of opportunity for Honeywell.
 - All areas of service offerings (i.e., voice, data, image, message and text) are showing signs of exceeding even the most optimistic forecasts.
- The key to any on-line system is the underlying communications system.
 - There is currently a wide variety of such services, and the range of available options promises to expand dramatically in the near future.
 - Exhibit III-1 lists the major suppliers of communications services.
- AT&T and its Bell operating companies own the largest portion of the domestic public telephone network, which can also be viewed as a data communications network because, through an acoustic coupler, every telephone instrument can be turned into a data communications station.

EXHIBIT III-1

MAJOR SUPPLIERS OF COMMUNICATIONS SERVICES

- TRADITIONAL LEADING COMMON CARRIERS:
 - AT&T AND ITS BELL SUBSIDIARIES
 - GTE (GENERAL TELEPHONE AND ELECTRONICS)
 - UNITED TELECOMMUNICATIONS, INC.
 - CONTINENTAL TELEPHONE CORP.
 - CENTRAL TELEPHONE AND UTILITIES
 - WESTERN UNION (TELEX AND TWX SERVICES)
- SPECIALIZED COMMON CARRIERS:
 - SPCC (SOUTHERN PACIFIC COMMUNICATIONS CO.)
 - MCI COMMUNICATIONS CORP.
 - UNITED STATES TRANSMISSION SYSTEMS (USTS)
(SUBSIDIARY OF ITT)
- SATELLITE COMMUNICATIONS:
 - AT&T COMSTAR
 - RCA SATCOM
 - WESTERN UNION WESTAR
 - AMERICAN SATELLITE CORP. (ASC)
 - SATELLITE BUSINESS SYSTEMS (SBS)
 - XEROX/WESTERN UNION INTERNATIONAL (XTEN)
 - SPCC
 - HUGHES
- VALUE ADDED AND PACKET-SWITCHED PUBLIC DATA NETWORKS:
 - TYMNET
 - TELNET
 - GRAPHNET
- INTERNATIONAL RECORD CARRIERS (IRCs):
 - RCA GLOBAL COMMUNICATIONS
 - ITT WORLD COMMUNICATIONS
 - WESTERN UNION INTERNATIONAL
 - TRT TELECOMMUNICATIONS
 - FTC COMMUNICATIONS

- AT&T's portion of the system is interconnected with a number of independent systems, the largest one being that of GTE (16 million phones), followed by United Telecommunications (4 million phones), Continental Telephone (3 million) and Central Telephone (1 million).
- Western Union (WU) is the premier domestic "record" carrier; i.e. provider of communications between teleprinters. Western Union now operates both its original, baudot-code-oriented Telex system, and the ASCII-oriented TWX system, originated by AT&T's subsidiary, Teletype Corp., and since sold to Western Union. WU has established a computerized network, based on WU's own transmission facilities as well as leased facilities from AT&T, to permit cross-communications between these two incompatible record systems. WU also offers private line services similar to AT&T's.
- The driving forces that are pushing communications to its rapid growth in the 1980s are:
 - The improved price/performance of semiconductor technologies that defy the inflationary trends of today. It is extremely economical to convert from analog to digital switcher, to transmit voice as computer pulses, to send data and voice by satellite as opposed to copper wire and to replace wire with fiber optics. Even the monopolistic dominated area of communications dominated by monopolies is bending to the lure of silicon technology.
 - The need for information has created data bases; the utilization of this information by business has become a necessity in their complex operations. Information that is stale (even though it is only hours old) is useless for modern management. In a competitive environment, the quality of information could be the deciding factor between profit or loss.

- The need to improve worker productivity.
- In the 1960s and 1970s, blue collar productivity increased 90% while white collar workers improved a mere 4%. The lack of adequate business communications networks has been an impediment to the evolution of the "office of the future." Once available, they will form the backbone for improved white collar productivity.
- The decreasing availability and increasing cost of energy will accelerate demands for automated solutions to emerging energy-reglated business problems. For instance:
 - . The need to reduce business trips could be resolved through effective video conferencing.
 - . Terminals, FAX, communicating word processors and other devices could help create a business environment in which more work could be performed at home rather than in the office.
 - Multinational companies, requiring full awareness of the day-to-day conditions of their geographically dispersed operations, are accelerating the need for corporate data and voice networks at reasonable costs.
- Forces that are retarding the communications industry growth are:
 - The sheer size and control of the communications services by AT&T and the 1,600 independent phone companies. In spite of the "Carter-phone decision" in 1968, non-telco firms accounted for less than 5% of the estimated \$55 billion in revenues for the communications industry in 1979. While non-telco companies are projected to double their revenue by 1984, the revenues for the industry will have increased to an estimated \$84 billion and hence their "slice of the pie" is still small. However, the prodding by non-telco vendors has "awakened the giant" who is beginning to move in a more aggressive non-monopolistic manner, to the benefit of users and vendors alike.

- The government-regulated nature of the industry, which involves agencies from units as small as cities, to states, federal agencies and Congress.
- The proliferation of new products, offerings and services which has tended to confuse the user.
- The shortage of qualified personnel who are knowledgeable in both computers/communications and telephones. A recently published survey revealed that the 100 largest corporations estimated they were understaffed in these skills by an average of 39% and were unable to find the personnel to fill these positions.
- The size of the present investment in plants and equipment precludes an overnight change for telcos as well as users.

- Following a landmark FCC decision in 1971, a number of "specialized common carriers" entered the market of point-to-point, private, interstate communications links. They include:
 - Southern Pacific Communications Co. (SPCC), a subsidiary of Southern Pacific transportation (railroad) company. SPCC has an extensive microwave network of its own, which also includes the facilities originally established by Datran, an early specialized common carrier that went bankrupt and was sold to SPCC.
 - MCI Communications Corp., which also has a microwave transmission system.
 - United States Transmission Systems (USTS), a subsidiary of ITT.
- Satellite communications have become a commercial reality, with the following participants:

- Western Union with its own Westar satellites.
- RCA with its Satcom satellites (of which perhaps the best known is the Satcom III, "the one that got away" - it was lost in space without trace).
- American Satellite Corp., a subsidiary of Fairchild that leases satellite channels from WU and resells them in various formats, especially in an all-digital service dubbed SDX.
- AT&T, which has its own satellites (Comstar series) but is prevented by FCC rulings from using them in the private line offerings. They are used instead to augment the switched network.
- Satellite Business Systems, a venture owned jointly by Comsat, IBM, and Aetna, which plans to launch its first satellite in 1980, offering a wide variety of voice, data, and image transmission services.
- Xerox, which has filed with the FCC for a satellite-based communications service called XTEN; the FCC has not yet ruled on the filing. Initially a separate Xerox activity centered in Los Angeles, XTEN is undergoing an organizational upheaval as its charter is being moved to New York under Western Union International (WUI) - the international arm of WU that Xerox purchased in late 1979.
- Southern Pacific, which currently leases satellite channels from RCA and is planning to launch its own satellites within the next two years.
- Hughes, a major satellite builder, which has also filed with the FCC for permission to launch its own communications satellites.

• Value added and packet-switched public data network services are becoming more viable. The three leading VANs are:

- Tymnet, a subsidiary of Tymshare (a remote computing service firm).
- Telenet, now a subsidiary of GTE.
- Graphnet, an offering of Graphic Scanning Corp. customized to facsimile transmission. However, Graphnet has also received FCC permission to offer record services in competition with Western Union.

- In 1978, AT&T filed with the FCC an ambitious value added, packet-switched offering dubbed ACS - Advanced Communications Service. The service is facing regulatory and judiciary hurdles, but the issue is currently moot because AT&T has withdrawn its filing due to what it describes as "software problems." Sources close to the problem say that the real issue concerns the computers initially selected to act as switching nodes (DEC's 11/34 and 11/70) which have proven too underpowered for the task. The switch to the more powerful VAX 11/780 is not only causing a software problem, because the VAX is not fully compatible with the PDP-11s, but also places in question the economics of the service.
- Related to the issue of data communications are the international record carriers (IRCs), which traditionally maintained teleprinter services between the U.S. and foreign countries. The relations between IRCs and domestic carriers (not only record carriers) are becoming fuzzy due to FCC rulings that permit more competition from IRCs in the domestic market on the one hand, and on the other, more international record activities by U.S. domestic carriers of all sorts. The issue is further complicated by various schemes now employed by a number of U.S. firms to offer international record and data services, bypassing the IRCs. The major IRCs today are:
 - RCA Global Communications (Globcom).
 - ITT World Communications (Worldcom).

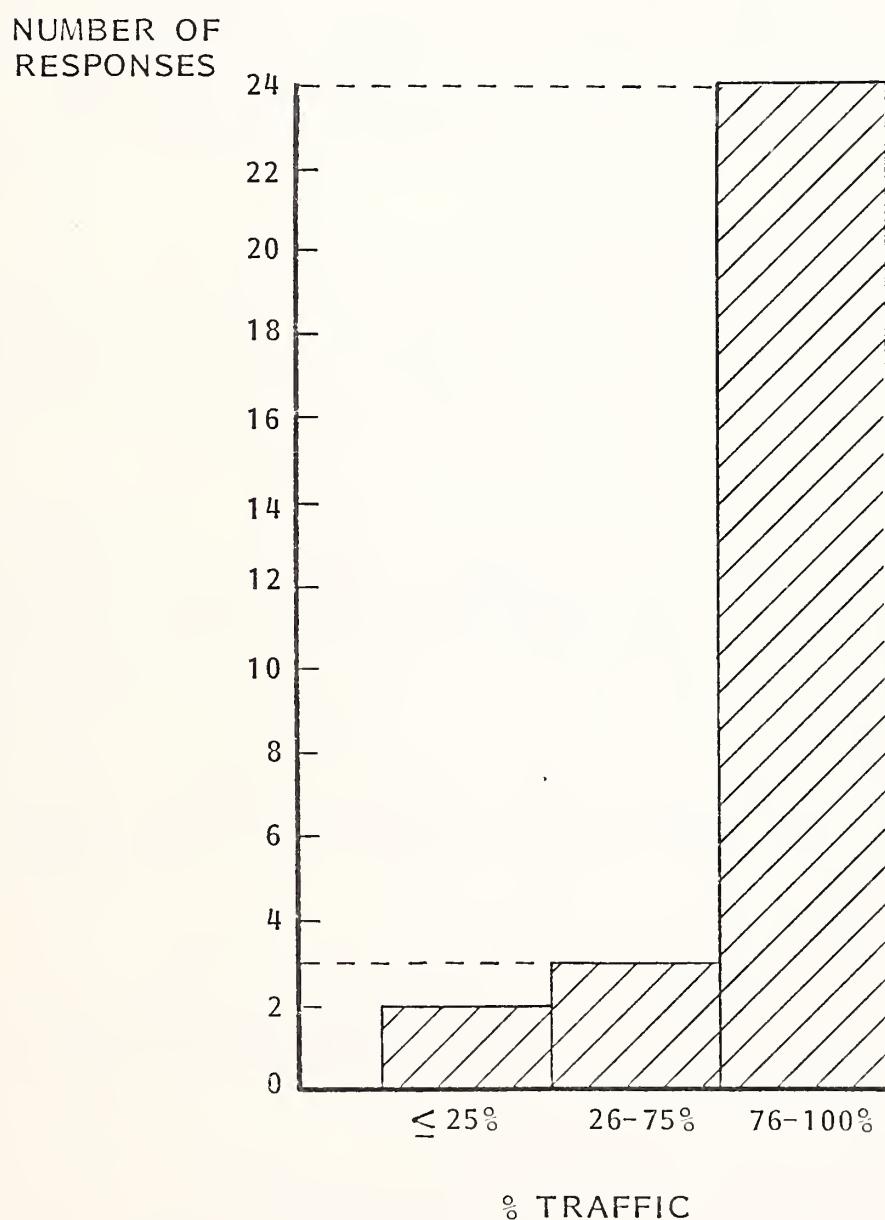
- Western Union International (now a Xerox subsidiary) with International Telex.
- Several others, including TRT Telecommunications and FTC Communications.

2. TRADITIONAL AND CONTEMPORARY DATA COMMUNICATIONS SERVICES

- AT&T, via its wholly owned (or majority-owned) Bell subsidiaries, with 100 million installed telephones, has 82% of all local telephone service in the U.S.
- Every one of those telephones can be turned into a data communications device with the addition of a simple, inexpensive (about \$100) acoustic coupler, which is a special form of a modem (modulator-demodulator), a device for converting between digital data and the analog signals suitable for transmission over the traditional telephone network.
- In this sense, the circuit-switched public telephone network in the U.S. may be viewed as one huge data communications network, with access to and from over 120 million "stations" or phone instruments. This network includes not only AT&T facilities, but also those of other common carriers (such as GTE), as shown in Exhibit III-2.
- Fully-electronic modems, from Western Electric and a large number of independent PCMs, can also be attached to the circuit-switched public telephone network Data Access Arrangement supplied by the phone companies. Such modems can operate at much higher speeds than acoustic couplers, which are typically limited to 150-300 baud (approximately 20-40 characters/sec).
- The advantages of using the public telephone network as a means for supporting an on-line data system are fairly straightforward:

EXHIBIT III-2

PERCENT OF DATA MESSAGE TRAFFIC CARRIED ON PRIVATE LINES



- The network exists and reaches practically every locality in the U.S., with direct dialing to Canada as well.
- Access to the network is relatively simple. A modem or an acoustic coupler will do.
- At the host computer end, equipment is available to permit computer-controlled dialing ("Auto-Call" units), automatic answering of incoming calls ("Auto-Answer"), and automatic allocation of a number of incoming calls to lines on a first-come, first-served basis ("Rotary").

- The disadvantages are:
 - Communication speeds are generally limited to 1,200-2,400 baud, suitable for interactive terminals but too slow for remote batch or buffered CRT terminals.
 - The network is expensive to use, especially for interactive terminals with long connect times and small amounts of data transmitted, because charges are based primarily on connect time (modified by the distance covered and the time of day at the point of origin of the call).
 - The dialing required each time in order to establish connection is a nuisance to the terminal user and a time-waster for computer-originated calls.
- Two popular techniques to alleviate the speed and cost disadvantages are multiplexing and concentration. Although often used as synonymous terms, there is a basic difference:
 - In multiplexing, the terminals dial a local number which connects them with a scanning device (multiplexor). With a time division multiplexer (TDM), each terminal is given a particular time slot in the scanning order. A leased line (typically) connects the remote multiplexor with

the host computer, either via the intelligent front-end processor (FEP), or via a demultiplexor, which breaks out the characters from each remote terminal. The effect is that the host "sees" multiple, low-speed lines going to the remote terminals.

- With a concentrator, terminals also dial a local number which connects them to an intelligent processor with buffer memory; a complete message from a terminal is accumulated in the concentrator's buffer memory before being shipped to the host FEP at full line speed. The host "sees" a single high-speed line carrying interleaved messages from multiple terminals.
- The difference is that with unintelligent multiplexing, the leased line speed must equal the combined speeds of all terminals that can possibly be active at any one time. With concentration, line speed can be traded off for more buffering at the remote concentrator, thus avoiding the cost of a line speed which is achieved only for brief peak periods.
- Multiplexors cost approximately \$2,000-6,000, while concentrators are generally much more expensive.
- Multiplexors and concentrators are available from a wide range of independents, but they can also be leased from AT&T (Datrex service) or from Western Union (Datacom service).
- In the last few years, moderately-priced Intelligent Time Division Multiplexors (ITDM) have appeared, which combine pure multiplexing with concentrator features.
- Another solution to the cost problem of the switched network is WATS (Wide Area Telephone Service). This scheme, offered by AT&T, allows essentially unlimited calls (up to 240 hours/month) for a fixed monthly fee (typically \$1,700). There are many factors which determine the actual cost, but essentially, when your monthly phone bill reaches \$1,500 or so, WATS may be

an attractive solution. Both inbound ("800 number") and outgoing WATS lines are available, with the options of limited geographical coverage or nationwide coverage.

- Nevertheless, as Exhibit III-2 indicates, the majority of data traffic is carried not by the switched network (often called "dial-up"), but by private lines.
- Private lines can be privately constructed and owned (e.g., within an organization's geographical compound, by using microwave or infra-red, line-of-sight equipment) but by and large, "private" lines are actually non-switched arrangements leased from the local phone company.
- Charges for private lines are set by the local phone company (under control of the state's PUC) if the line is within the state, or by AT&T or other carrier (under FCC control) for interstate lines.
- Private lines are now also widely available from Western Union and from specialized common carriers such as SPCC and MCI.
- Private lines have two main advantages:
 - Much greater speed can be supported (19.2, 50, 230.4 baud and above), although voice-grade lines are still the most popular, and can carry up to 9,600 baud with special "conditioning" of the line.
 - No dialing is required - connection is continuously maintained.
- Concentration or multiplexing can be used as described above for increasing the utilization of leased lines.
- Another technique available on leased lines is "multidropping," a scheme by which several terminals can physically attach to the same leased line at the remote location.

- Multidropped lines must be managed in some way to avoid having two or more terminals attempting to send or receive simultaneously.
- The most popular method for control of multidropped lines is "polling," a technique by which one of the stations connected to the line (typically the remote host or its FEP) is the master station, which polls the "tributary" or "secondary" stations to determine if they have anything to send.

- Still another technique available with leased lines is the FX (Foreign Exchange) service, provided by local telephone companies to allow local subscribers dial access to an intercity leased line.
- A related service called CCSA - Common Controlled Switching Arrangement - permits the establishment of private, multicity phone networks by using the telephone companies' local exchanges and intercity trunks, and AT&T's interstate lines.
- Specialized common carriers and others have a host of existing or proposed switched, intercity voice services that have some of the flavor of WATS, FX, and CCSA, specifically:
 - Execunet from MCI (existing).
 - SPRINT from SPCC (existing).
 - Metro I from Western Union (proposed).
 - City-Call from U.S. Transmission Systems, a subsidiary of ITT (proposed).

3. DIGITAL SERVICES

- The traditional telephone network is "analog" as opposed to "digital" in the sense that, though the switching mechanisms (first relays and now electronic switching systems) have always been digital, the information transmitted through 90% of the network is still in the form of continuous tone signals.
- When digital data is to be transmitted, it is first converted to continuous tone signals by the modem.
- In a relatively recent development, portions of the network are being replaced and/or complemented by purely digital transmission facilities.
- The advantage of digital data transmission is that it is possible to sustain much higher transmission speeds at the error rates comparable to voice channels, or to sustain traditional data rates with much improved (two orders of magnitude) error immunity.
- This is due to the fact that, with repeaters placed along the line, it is possible to reshape and reconstruct the digital data stream as many times as desired, eliminating distortion due to propagation as a source of error (random noise, of course, still remains).
- Another advantage in theory is that digital data from and to computers can be transmitted on a digital network without modems. In fact, some type of interface box is required even with a digital network, although it is true that these digital interfaces are simpler and less expensive than analog modems.
- AT&T offers two versions of end user, digital transmission services;
 - Private line service, called Dataphone Digital Service (DDS).
 - Switched (dial-up) service, called Dataphone Switched Digital Service (DSDS).

- DDS is a full-duplex, point-to-point or multidrop, private line facility operating synchronously at speeds of 2,400, 4,800, 9,600, and 56,000 baud. The service is available in some 40 cities.
- DSDS is a dial-up companion to DDS. It is a later development, and is available in a limited number of cities. Speed is 56,000 baud.
- AT&T plans to increase the speeds available on DDS to 1.5M baud.
- Western Union also offers a digital Multipoint Data Service (MDS) at speeds of 1,200, 2,400 or 4,800 baud, full-duplex.
- The satellite-based service from American Satellite Corp., dubbed SDX, is also a completely digital service.
- The next few years are likely to see great expansion of digital services at the end user level.

4. PACKET SWITCHING

- Packet switching is an alternative to circuit switching as a method of sharing the resources of a common network, such as the telephone network, among multiple users.
- The first notable use of packet switching in the U.S. was in the ARPA (Advanced Research Projects Agency) network, which linked a variety of makes and models of computers around the country.
- In a circuit-switched arrangement, an actual physical circuit is established between the two subscribers via dialing; the circuit is maintained for the duration of the session, whether or not data are being transferred. Since costs are dependent in part on the connect time, this can be an expensive arrangement for interactive terminals, where "head scratching" is high relative to data transmission.

- In one packet-switching implementation, the message to be transmitted is broken up into fixed-size packets, each of which carries the address of the receiving station or destination. Each switching node in the network looks at the address in the packet and decides how to route the packet to the next node. Each packet is individually switched, possibly through many intermediate nodes, before arriving at the node to which the receiving station is connected. The packets are reassembled, if necessary, at that node and delivered to the receiving station in the order in which they were originally transmitted.
- For the duration of the transmission of a message, possibly composed of many packets, a "virtual circuit" is said to exist between transmitter and receiver; in reality, the physical connection between network nodes is not switched.
- The most important advantages from the user's point of view are:
 - Pricing is independent of the distance between stations.
 - Pricing is primarily determined by the volume of data transferred rather than the connect time (however, there are connect time charges).
 - Depending on locations, access to the entire network is via low-cost local loops (i.e., the terminal user dials a local number, assuming the network has a node available in the city).
- The major suppliers of packet-switched network services are:
 - Tymnet, a subsidiary of Tymshare.
 - Telenet, a subsidiary of GTE/Communications Network Systems.
- Although both services can be classified as packet-switched, and do share a number of characteristics (such as obtaining the physical communication

facilities from the common carriers, and reselling them packaged with additional network services - hence the name Value Added Network Services or VANS), Tymnet and Telenet do differ in numerous details of implementation, user interfaces, geographical availability, transmission speed and rate structure. As implemented:

- Telenet uses a maximum packet size of 128 characters; in Tymnet, the packets are fixed at 64 characters.
- In Telenet, each packet is uniquely associated with the originating terminal; in Tymnet, packets are assembled from character streams generated by the various terminals connected to the node.
- In Telenet, packets are dispatched when the originating station sends an agreed-upon character (e.g., carriage return), or after an agreed-upon time has elapsed - whether or not the packet is full; in Tymnet, where packets are built with data from many terminals, packets are almost always full.
- Telenet uses adaptive routing algorithms that decide how best to route each packet; in Tymnet, a physical routing is selected when the originating terminal established the call, and the route then remains unchanged for the duration of the session.

• The two networks also differ in their interfaces:

- In Telenet, a host computer interfaces to the network either via a Telenet-supplied interface processor (TP1000, TP2200, or TP4000 models), which performs the conversion between the X.25 packet-switched protocol and the asynchronous or synchronous protocol most convenient to the user's host software; alternately, if the host computer supports the X.25 protocol in its native software, it can tie directly into the network. The Telenet node computers perform the protocol conversion for the remote terminals.

- In Tymnet, the interface between the network and the host computer is a specialized bisync protocol, while remote terminals can be synchronous or asynchronous, with protocol conversion performed for them by the node computers. (Tymnet does support X.25 for its gateway connections to Canada's Datapac network and to Telenet).
- Telenet nodes are currently available in some 90 U.S. cities; the network is interconnected with Datapac in Canada and with 30 other foreign countries. Tymnet's coverage is more extensive, having nodes in some 130 U.S. cities, and roughly comparable international coverage.
- Telenet supports transmission speeds of up to 56 Kbps, while Tymnet currently offers a maximum of 4,800 bps.
- The rate structures for both networks are quite complex and depend on a large number of factors; a particular point of departure is that Telenet's volume charges are per thousand packets, while in Tymnet, data volume is charged on a per-character basis.
- In addition to packet-switched transmission, Tymnet also offers a message-switching (electronic mail) service called OnTyme. Telenet offers only the basic packet-switched transmission, but it has more varieties of service, including PPX (Private Packet Exchange), night-time reduced charges, and a "permanent virtual circuit" service similar to a private leased line, called "Hot Line." Recently, Telenet announced plans to implement an electronic mail service.
- Although packet switching is gaining momentum both in the U.S. and abroad, it is still in its infancy. An INPUT survey of 35 users of large DP centers found only one that employed the public packet-switched network for attaching remote terminals to a host computer.

- It is also worth recalling that when GTE acquired Telenet, that network was in dire financial straits - though GTE gives every indication of being committed to the support and expansion of Telenet.
- Although not yet available, the proposed ACS service from AT&T, and XTEN from Xerox/WUI, will probably utilize packet switching in their data communications offerings.
- A very general rule of thumb is that packet-switched networks should prove an economical alternative for attaching low-speed, interactive terminals and for electronic message exchange, but the user contemplating signing up for one of these services would be well advised to conduct a careful study to determine the costs and to compare those to the alternatives of using the public circuit-switched network, private lines with multiplexing/concentration, or even the services available via satellites.

5. SATELLITE SERVICES

- By the early 1980s, new transmission services will come into being that will employ advanced satellite and microwave technology plus an upgraded telephone system.
 - These services are expected to become the major medium for long-distance communications for large organizations in this decade. They represent a major step toward the office of the future as they facilitate communication of voice, text, data and images.
- The front-running companies for the business transmission dollar are:
 - SBS (Satellite Business System), a joint venture between IBM, COMSAT and Aetna Life. SBS, via its system design, is targetting the market for its services to large, geographically dispersed organizations. While this

system can handle all forms of transmission, including voice, it offers a wide variety of digital interfaces with speeds from 2.4kb/s to 6.312 Mb/s for data transmission, which is IBM's mainstay.

- IBM's SNA (System Network Architecture) has preceded AT&T's ACS (Advanced Communication Service) to the market. Since SNA requires substantial user programming, those who have committed to its installation will face a considerable conversion effort if they later switch to ACS. Users of SNA will find it easier to use SBS than other services, while not using SNA will find SBS difficult. IBM's marketing strategy is to convert as many users as possible to SNA and then at a later date, to attach them to SBS while locking out AT&T.
- AT&T has an unnamed scanning beam system service for data transmission by satellite and ACS which will most likely be available over leased or dial lines. ACS is an "omnibus transmission service" that promises to allow almost universal attachment of non-compatible devices and, via software, to allow the units to connect to the world. (Needless to say, ACS has been delayed due to software and other problems.) Considering that products within a single vendor's product line may not be compatible for transmission, ACS is an ambitious effort.
 - ACS is to offer packet switching for bulk and interactive transmission of data message switching and facilities for preparing, editing and validating messages.
 - ACS will be terminated by a modular telephone jack on the customer's facility, while the termination for the scanning-beam system service will be a ground-based station.
- Other organizations in the business of satellite transmission include Xerox (XTEN) and Western Union (WESTAR).

- Some of the unique properties of satellite links involve:
 - The 270 millisecond propagation delay, which can be disconcerting in voice connections. This constitutes a major factor to be reckoned with in data transmission design.
 - The ability of the users to have access to very high bit rates if they utilize their own antenna and avoid local loops.
 - The satellite signal itself, which, unlike a terrestrial link, is broadcast to all receivers within range of the satellite antenna. Because of this, dynamic assignment of channels is possible between geographically dispersed users. While this yields economies on a scale not available with a terrestrial link, it also requires new forms of transmission control and security procedures.
 - The ability of the transmitting station to receive its own transmission and to check the accuracy of the data presented, received and broadcast.
- User's interest in and desire to utilize satellites are limited to several factors, some of which are already extant while others are promises of future development. Some of the advantages perceived by users are:
 - Clearer, cleaner transmission with fewer errors.
 - Wide band capability for transmission at higher rates of speed at a cost equal to or less than present wire/microwave combinations.
 - A bundling of all classes of services (i.e., voice, data, image, message and text) plus video conferencing into one source.

- The cost of using satellites is dropping rapidly. As an example, the family of INTELSAT satellites represent, four generations of satellites in six years.
- The cost of a satellite voice circuit per year,

Cost of the Satellite + Cost of the Launch

Average Number of Voice Circuits X Design Lifetime,

has dropped from \$23,000 for INTELSAT-I to \$58 for INTELSAT-V.

- The cost of earth stations is also dropping.
- The first COMSAT earth station cost \$10 million. It can now be replicated with stations costing \$100,000.
- Vendors perceive many benefits from satellite service offerings.
 - Value added services will include the built-in restriction of satellite utilization; i.e., broadcast features will be touted as an advantage and billed to the user accordingly.
 - By using geosynchronous satellites, vendors have removed many of the limitations of low-orbit or medium-altitude vehicles. Geosynchronous satellites appear to be parked over the equator. However, they have an orbital rotation path of 24 hours in the same direction as earth. Three such satellites can cover the entire earth (with the exception of small, unpopulated areas near the poles).
 - The decreasing costs of earth stations are attracting more users to the program. This increasing user base requires larger satellites handling

more channels. Since present launch costs represent 50% or more of the vendor program's costs, additional channels represent a corresponding increase in the vendors' profitability.

- Switching calls from channel to channel or satellite to satellite in space is far cheaper than building terrestrial switching stations.
- All transmissions are digital, allowing for voice compression (eliminating the pauses) and hence better utilization of the circuit.
 - . Digital transmission also eliminates the present problems of handling voice and data on one line (a mixture of analog/digital).
- It costs the vendor no more to handle a user's overseas call than a domestic call, yet the service charges are higher.

- In January 1978, INPUT produced a mult-client study entitled "Value Added Network Services (VANS)."
 - This report was based in part on interviews with 154 potential or actual users, 30 vendors and five government agencies.
- In reporting users' attitudes, this study observed that:
 - "Support services are required to ensure that user networks are well designed and reliably operated. They are analogous to those services supplied in the EDP area, and consist of maintenance, fault location, network design and operation."
 - Personnel training is another area of concern to users. Only a small number of firms are currently addressing the problems involved in personnel training and network design.

- The projected monthly rental and method of termination for the services are:
 - SBS (ground station), \$18,000-60,000.
 - WESTAR (ground station) \$15,000-75,000.
 - AT&T Scanning-Beam Satellite (ground station), \$5,000-50,000.
 - XTEN (microwave user terminal), \$1,000-8,000.
 - ACS (leased line or dial part), \$200-300.
- Neither purchase prices nor associated maintenance rates have yet been determined.

6. THE COMMUNICATIONS MARKET AND HONEYWELL

- The maintenance of ground based stations is a promising market entry for Honeywell.
 - A ground station is defined as the terminator equipment (i.e., antennae and electronics) required to transfer signals from the ground site and/or to receive signals from a target satellite.
- The ground-base station market segmented is by size (ie., diameter of the antenna disk) into:
 - Very large systems (antennae of more than 10 meters), each with a cost in excess of \$10 million.
 - . These systems are complete turnkey operations and are marketed to U.S. and foreign governments.

- Medium-to-large systems (antennae of 5-7 meters), with prices ranging from \$250,000 to more than \$1 million.
 - . These systems are sold to common carriers such as AT&T, RCA and Western Union as well as specialized carriers like MCI and SBS.
 - . While these systems are purchased from an antenna manufacturer, a mixture of equipment from many sources is generally required to achieve a complete ground station. (As an example, the earth stations for SBS are assembled by Hughes Aircraft using its own radio frequency terminals plus time division access modems from Fujitsu, satellite communications controllers from IBM and port adaptor systems from Nippon Electric.)
 - . INPUT projects that there will be approximately 100 medium-to-large ground stations employing 1,500 field engineers by the end of 1980, with a purchase value of \$40 million. By the end of 1985, projections indicate that there will be 800 earth stations of this size employing 8,000 field engineers, with a purchase value of \$320 million.
- Medium-to-small systems (antennae of 3-5 meters), with prices ranging from \$20,000-250,000.
 - . These systems are used by CATV, which is perceived by the vendors as the most rapidly growing segment of the ground station market.
 - . In 1979, there were 3,000 CATVs in operation, with earth stations valued at \$60-105 million. It is estimated that by 1985 there will be 12,000 earth stations installed with CATVs (some of which will have two systems for different satellites) valued at \$240-420 million.

- . Another significant market, the hotel and motel industry, is emerging for this class of earth station. Holiday Inns has a total of 125 stations installed or on order from Scientific Atlanta and Microdyne, and projects growing to 1,400 by 1983.
 - . The market for hotels/motels is projected to reach 3,500 stations by 1985, with a purchase value of \$70 million.
- This market is based on small systems (antennae of less than 3 meters) with prices under \$20,000 or monthly rental fee of \$25-35, excluding satellite service.
- . These ground stations are slated for home and apartment house installation. COMSTAT and Sears have just broken off discussions for entry into this market.
 - . The mass market for home systems is vulnerable to CATV, which will provide equal service for less money.
- U.S. companies in the antenna business include Scientific Atlanta, Harris, Comtech Labs, Ford Aerospace, Microdyne, M/A Communications, California Microwave, TRW and Hughes.
- The size of the antenna required is determined by the geographic location of the earth station as it relates to the "footprint" of the satellite the amount of local interface from nearby radiating antennae, the height of the satellite or device to be tracked, and the quality desired of the receive/transmit signal.
 - There are companies such as Compucon and Spectrum Planning, that provide services to determine the size of the antenna disk and other related criteria for a specific installation.
- The increase in the number of ground-based stations has given rise to distribution vendors (some of which were in the radio and TV tower business)

such as Ft. Worth Tower, U.S. Tower, Servision, WICI, Gardner Enterprises and STS.

- INPUT recommends that Honeywell explore this market and further evaluate entering via:
 - OEM-TPM for the CATV, hotel/motel sector in concert with a manufacturer of 3-7 meter antennae.
 - Joining a consortium (i.e., Jones-Mansville, Hughes, Southern Pacific or Metropolitan Life) in launching a satellite.

7. SUMMARY OF AVAILABLE SERVICES

- Exhibit III-3 summarizes the most popular communications services currently available.

8. INTERCONNECT

- The interconnect market is loosely defined as PBX (private branch exchange) and associated telephones supplied by a non-telco operating company. The interconnect is "on the wall" in front of the PBX.
 - The term PBX is a telco term, as they do not use PABX (private automatic branch exchange) or CBX (computerized branch exchange). Non-telco firms and most users tend to think of PBX as manual, PABX as automated to some extent, and CBX as computer-driven and totally automatic.
- The private interconnect market started explosively. Dozens of major companies rushed to enter the market and almost as rapidly withdrew or retrenched.

EXHIBIT III-3

**SUMMARY OF
CURRENT COMMUNICATIONS SERVICES**

SERVICE	LOW SPEED (TTY)	MEDIUM SPEED (TO 9600 BAUD)	HIGH SPEED (OVER 9600 BAUD)
SWITCHED (DIAL-UP), ANALOG	WU TWX/TELEX AT&T SERIES 1000 WU SERIES 1000 MCI, SPCC	AT&T DDD WU	AT&T DATA- PHONE 50
SWITCHED, DIGITAL	WU TWX/TELEX AT&T SERIES 1000 WU SERIES 1000 MCI, SPCC	SPCC DATA DIAL	AT&T DSDS (56KB)
PRIVATE LINE, ANALOG	WU TWX/TELEX AT&T SERIES 1000 WU SERIES 1000 MCI, SPCC	AT&T SERIES 2000 & 3000 (MPL) SPCC MCI WU MPL	AT&T SERIES 5700, 5800 (TELEPAK); AT&T SERIES 8000 (WIDE BAND); WU 5000, 8800
PRIVATE LINE, DIGITAL	WU TWX/TELEX AT&T SERIES 1000 WU SERIES 1000 MCI, SPCC	AT&T DDS (2.4, 4.8, 9.6 KB)	AT&T DDS (TO 1.5 MB)
SPECIALIZED SERVICES: MULTIPLEX / CONCENTRATE	AT&T DATREX WU DATACOM	WU MDS AT&T FX AT&T CCSA AT&T WATS	-

EXHIBIT III-3 (CONT.)

SUMMARY OF
CURRENT COMMUNICATIONS SERVICES

SERVICE	LOW SPEED (TTY)	MEDIUM SPEED (TO 9600 BAUD)	HIGH SPEED (OVER 9600 BAUD)
SATELLITE SERVICES PRIVATE LINES ⁽²⁾	-	AMERICAN SATELLITE SDX ⁽¹⁾ RCA SATCOM SPCC ⁽¹⁾ WESTERN UNION WESTAR	
PACKET-SWITCHED SERVICES		GRAPHNET (TO 1200 bps) TYMNET (TO 4800 bps)	-
INTERCITY SWITCHED SERVICES	-	MCI EXECUNET SPCC SPRINT WU METRO I ⁽³⁾ USTS CITY CALL ⁽³⁾	-

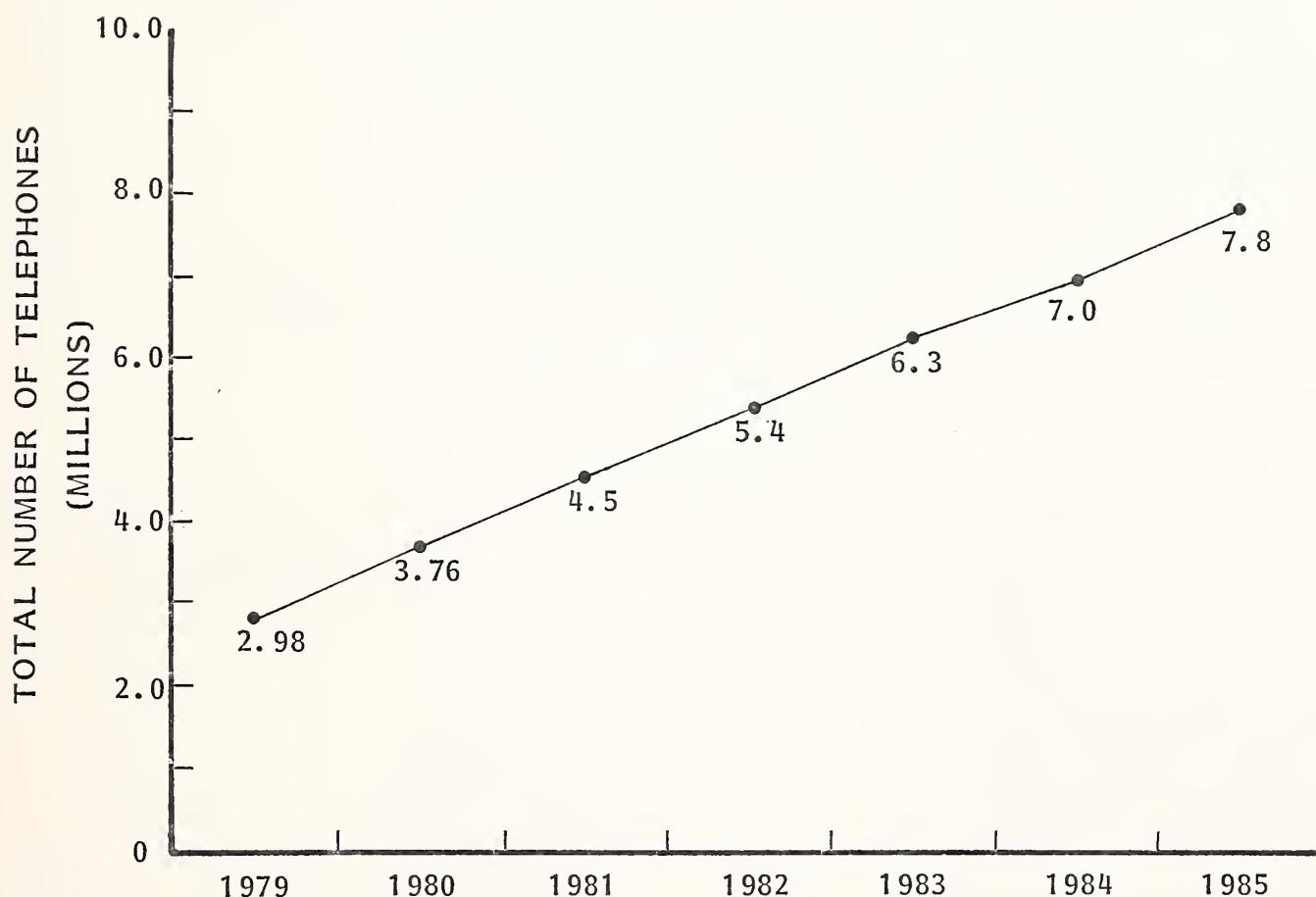
NOTES

- (1) ASC AND SPCC LEASE SATELLITE TRANSPONDER CHANNELS FROM WESTERN UNION AND RCA, RESPECTIVELY.
- (2) AT&T IS FORBIDDEN BY AN FCC RULING TO USE ITS COMSTAR SATELLITES FOR PRIVATE LINE OFFERINGS
- (3) PROPOSED SERVICES

- The initial market was driven by a number of factors.
 - Users desire to own their own equipment rather than rent from the phone company. (This is analogous to the data processing market of pre-1957 when Sperry-Rand offered its equipment for rent or purchase and IBM would rent only. The independents, like Sperry, have discovered this was a short-lived market.)
 - Cost savings inherent in purchase and elongated write-offs provided attractive incentives.
 - However, the most attractive aspect of the interconnect business was the wide range of features and capabilities not offered by the telcos.
- Industry sources have produced the following forecasts for growth in the private interconnect market:
 - The number of installed telephone sets will increase from 2.98 million in 1979 to 7.8 million in 1985 as shown in Exhibit III-4).
 - The growth rate is projected at 30% for 1979, 21% for 1980, 19% for 1981, and 17% for 1982.
 - Present maintenance and related services (i.e., installations, changes, moves, etc.) will grow from \$218.6 million in 1979 to \$442.2 million in 1985. Coupled with this growth is a projected increase in the percent of the total dollars for maintenance and service as it relates to total revenue (i.e., hardware plus maintenance and service). The percentage for maintenance and service will increase from 31% of the total revenue to 37% by 1982.
 - Total revenue for the private interconnect market is projected at \$1.189 billion for 1982, as shown in Exhibit III-5).

EXHIBIT III-4

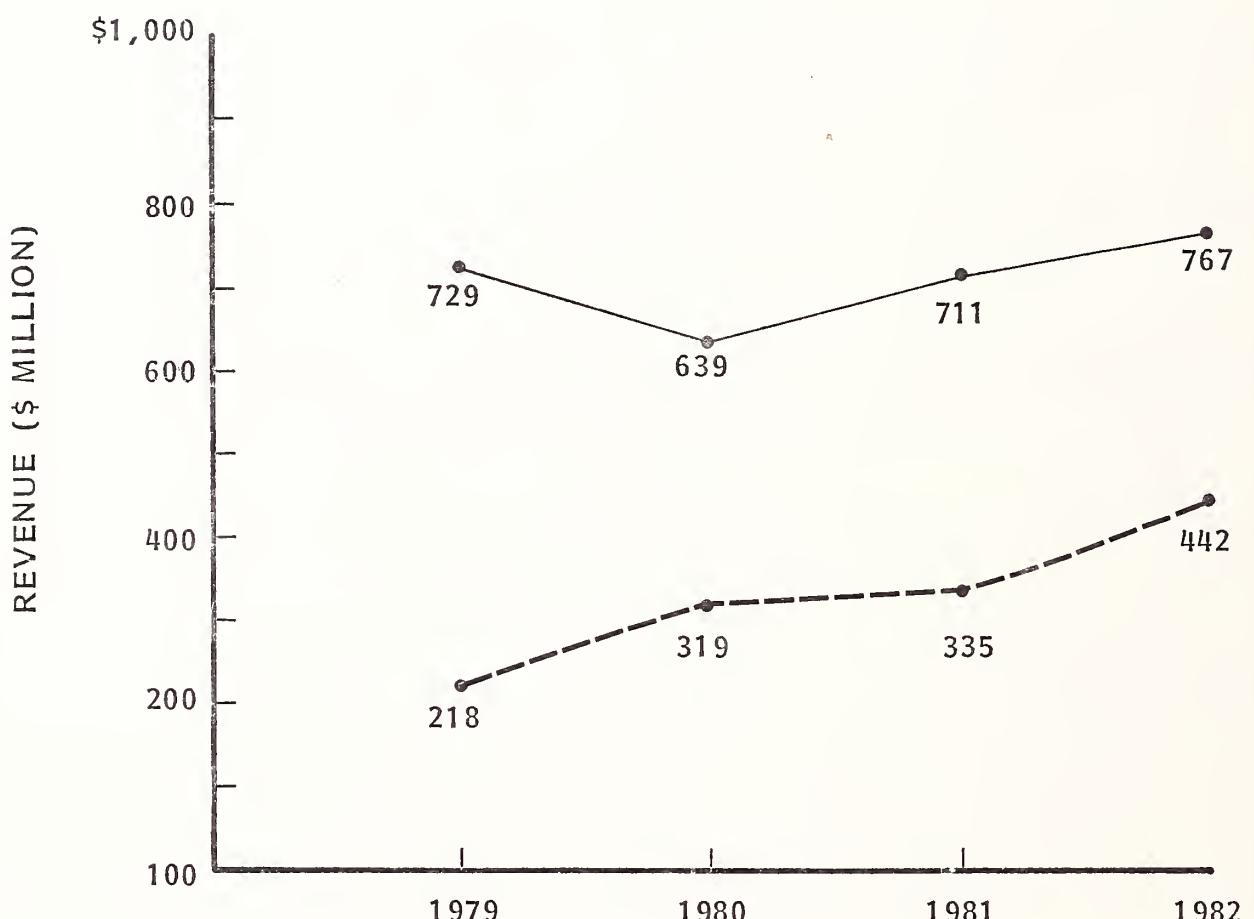
INCREASE IN PRIVATE INTERCONNECT
TELEPHONES INSTALLATION, U.S. ONLY*



*SOURCE = NORTH AMERICAN TELEPHONE ASSOCIATION

EXHIBIT III-5

FORECASTED HARDWARE AND MAINTENANCE REVENUE FOR
THE PRIVATE INTERCONNECT MARKET



HARDWARE REVENUE = _____

MAINTENANCE REVENUE = _____

- Industry sources differ on the percent of market penetration achieved by the independents, but place the 1980 numbers in the range of 10-21% and those for 1984 at 16-39%.
- The marketplace is very competitive and will become more so if AT&T is able to establish a non-regulated company to sell products to the private interconnect market.
 - While in this approach distributors tend to give the manufacturers a fixed return (i.e., no variable sales costs) which removes the maintenance problems, it is not all that advantageous.
 - . It doesn't get the manufacturer's name before the user's like a direct sales force can. Distributors are normally undercapitalized.
 - . Distributors cover small geographic territories and are less likely to make "the big sale" to geographically dispersed large accounts due to service coverage.
- There are approximately 15 manufacturers producing PBXs, of which 10 (out of 109 total listings) are listed in the Manhattan Yellow Pages under their own name for sales and service.
 - Some of the more prominent vendors are ITT, RCA and GT&E.
 - Rolm, which goes to market via distributors, has acquired one distributor and may be starting a move toward direct sales.

9. THE INTERCONNECT MARKET AND HONEYWELL

- This market meets all of the selection criteria established by Honeywell except that:

- Maintenance profitability is unknown, but estimated in the 15-20% range.
- The market is cluttered with small area distributors providing sales and service.
- This market sector lacks a defined leader offering an obvious OEM-TPM possibility.
- The annual sales rate is slowing.

- Market entry approaches for Honeywell include:
 - Direct contact with manufacturers such as OKI, Hitachi, Seimens, NEC, etc.
 - . While the method for seeling the product has been through distributors, the market is changing and so must the channels of distribution.
 - . IBM will soon enter the domestic market with the 3750 PABX, which has been offered in Europe and Canada.
 - . AT&T is rumored to be readying a PABX for sale in its new, nonregulated business groups.
 - . The PABX will be a key element in the "office of the future."
 - . The vendors and distributors realize that they will no longer have a viable product or market when IBM and AT&T decide to slant PABX towards the electronic office.

- In order to acquire a market entry base, Honeywell could acquire local distributors who, because of the 1980 sales slumps and the evolving nature of the market, are anxious to sell.
 - However, this approach would place Honeywell in a position of a distributor handling both sales and service.
 - The hardware vendors would welcome a large firm as a distributor as it would ease their market and product transition.
 - The distributorships are nonexclusive and as such are available nationwide.
- INPUT would recommend this marketplace to Honeywell as a method for entering the "office of the future," but not for short-term, OEM-TPM profitable revenue.

IV TURNKEY SYSTEMS

IV TURNKEY SYSTEMS

A. DEFINITION

- A turnkey system is defined as a "package" of software and hardware that is intended to fulfill a user's specific application requirements.
 - Turnkey system vendors, therefore, market directly to a specific area where there is a specific need. That is, they sell a "solution" to the end user.

B. MARKET STATUS AND TRENDS

- Turnkey systems are an important area for computer industry growth in the 1980s.
 - Computer processing services companies have a major role to play in this evolving market.
 - A key trend of the future is to sell solutions in the computer industry, not just hardware or software. Turnkey systems are a major part of this trend.

- INPUT estimates that there are over 4,500 vendors of turnkey systems in the U.S. today. This is twice the number of computer services companies that sell processing services, software products and professional services.
- The turnkey system market is changing. In addition to system houses or turnkey vendors, hardware manufacturers and processing services companies are selling or plan to sell turnkey systems.
- There are nearly 50 manufacturers that supply the hardware to the turnkey system vendors and processing services companies.
- There are 15 large processing services companies that currently sell turnkey systems, and that number will grow dramatically in the next five years.
- The turnkey system market is presently highly fragmented, with no single turnkey vendor having a significant market share.
- Nearly all turnkey vendors (except hardware manufacturers and processing services firms) cover regional markets. This is changing, however, as some of the larger vendors construct their own nationwide distributor networks.
- Several companies will emerge as national software manufacturers.
 - These vendors will design, develop and maintain software packages.
 - The software manufacturers will sell their software to turnkey vendors who will sell directly to end users.
- Market share data on turnkey vendors are difficult to obtain: although there is a large number of companies serving the market, no turnkey vendors stand out as major national suppliers. Historically, market share data have been reported by hardware manufacturers rather than turnkey vendors.

- The increasing competition has had a positive market impact since more prospects are being developed and are buying based on high perceived benefit/cost ratios.
 - DEC and Data General are the leading suppliers of hardware for turnkey systems.
 - Texas Instruments and IBM have recently achieved excellent growth rates in shipments and will be major competitors in the turnkey system market in the 1980s.
- Software, which has become the most critical part of the system, now provides most of the "value added" portion of a sale. Hardware manufacturers and other turnkey vendors rate software as the most significant profit generator.
- In fact, software development will be the key to future prosperity in the turnkey system industry.
- The increased need for software products, combined with the economics of producing and maintaining those products, will give rise to many new software manufacturers specializing in systems design, programming and systems maintenance.
- Software manufacturers will rely on dealers, distributors, agents and existing turnkey vendors to sell their software products to end users. The software products will initially be sold to the end user as part of a turnkey system. However, the availability of a wide variety of software products will provide end user distribution channels with add-on products to sell to existing customers.
- The software manufacturer, therefore, is filling an increasingly critical niche. As competition intensifies, many of these firms will be absorbed into larger companies.

- While turnkey vendors have a major share of today's market, the major hardware manufacturers and processing services companies will be taking a much more aggressive stance toward this market.
- Distributed data processing is gaining in importance due to economies of scale shifting towards smaller, interconnected, distributed computers. This trend will be boosted by offerings of automated office services.
- The turnkey system market is served by:
 - Hardware manufacturers.
 - Processing services companies, which have entered the turnkey system market and, in a limited fashion, are also manufacturing hardware.
 - Turnkey system vendors, which package OEM hardware and software to produce a complete system.
- Two markets are developing:
 - Small systems for small establishments and first-time users.
 - Larger systems for more sophisticated users.
- The turnkey market character will thus be determined by the interplay between the three types of vendors and the development of the two basic markets.
- Cost curves have an impact on these two markets.
 - Technology is driving the cost of hardware down, but a practical limit to the decreases will soon be reached.

- Printers and other mechanical devices are not experiencing dramatic price decreases and, barring major technological innovation, probably will not in the future.
- Users are buying more hardware for their interactive systems today than they purchased several years ago. Even with reduced hardware prices, the average turnkey system sale price has remained relatively constant for the last two or three years. This trend will continue through 1984.
- The overall effect of the cost curves and user buying trends will be a system cost in 1984 that is within 5% of the total system cost today. This is due in part to the increasing costs of software development and services, both of which are labor-intensive.

C. MARKET SIZE AND GROWTH

- There are three distinct parts to the turnkey systems market: hardware, software and services.
 - The hardware component includes the processor, storage, printers and other peripherals included in the turnkey system contract.
 - The software component includes systems software, application packages, and software customization included in the turnkey contract.
 - Services include installation, training and other costs included in the turnkey system contract.
- Together this market represented \$4 billion in revenues in 1979 and shipments of 61,000 turnkey units, as shown in Exhibit IV-1.

EXHIBIT IV-1

MARKET FORECAST FOR TURNKEY
SYSTEMS BY SYSTEM COMPONENT,
1979-1984

SYSTEM COMPONENT	1979 (\$ BILLION)	1984 (\$ BILLION)	AVERAGE ANNUAL GROWTH RATE 1979-1984 (PERCENT)
HARDWARE	\$2.4	\$ 8.9	30%
SOFTWARE	1.1	7.1	45
SERVICE	0.6	2.8	35
TOTAL	\$4.1	\$18.8	35%
SYSTEMS SHIPPED	61,000	279,000	35%

- The hardware portion of the turnkey system industry represents 23% of the dollar value of all minicomputers and small business computers sold in 1979.
- Turnkey systems markets will grow significantly over the next five years. Overall growth is expected to be 35% per year through 1985, representing a \$18.8 billion market by that date.
- Growth for the three types of vendors is shown in Exhibit IV-2.
 - Processing services firms will have a 125% per year increase in turnkey system sales. Proper planning will be required to reach this growth potential profitably.
 - Turnkey system vendors will grow 20% per year through 1984.
 - Hardware manufacturers will grow 51% per year through 1984.
- Increased pre-tax profit margins are expected in 1979.
 - It is significant to note that many turnkey system vendors have experienced low profit margins. This is expected to continue for the vendor that does not sell industry and function-specialized systems.
 - Vendors that sell highly specialized turnkey systems have higher profit margins than those that do not sell specialized systems.
- Follow-on hardware and software sales are not included in the forecast for turnkey systems, but are clearly important factors in the market.
 - The follow-on sales of hardware, software and professional services sold separately, after installation of the turnkey system, represent a major market opportunity.

EXHIBIT IV-2

**MARKET FORECAST FOR TURNKEY SYSTEMS
BY VENDOR TYPE, 1979-1984**

VENDOR TYPE	1979 (\$ BILLION)	1984 (\$ BILLION)	AVERAGE ANNUAL GROWTH RATE 1979-1984 (PERCENT)
HARDWARE MANUFACTURER	\$ 0.5	\$ 3.8	51%
PROCESSING SERVICES COMPANY	0.1	6.1	125
TURNKEY VENDOR	3.5	8.9	20
TOTAL	\$ 4.1	\$ 18.8	35%

- An average of 20% of revenue comes from follow-on sales.
- By 1984, the market for follow-on sales will approach \$5 billion. This is incremental to the \$18.8 billion forecast in Exhibit IV-2.
- Maintenance of software and hardware is projected at \$3.5 billion in 1984. This is also incremental to the \$18.8 billion forecast.

D. DRIVING AND RETARDING MARKET FORCES

- The driving and retarding market forces were derived from the principal vendors of turnkey systems and reported in an earlier INPUT report.
- Respondents were asked to evaluate a set of factors according to their importance in either fueling or limiting the growth of turnkey system sales.
- Hardware manufacturer respondents indicated that four major factors were responsible for fueling the growth in turnkey systems:
 - Systems are offered at a low cost.
 - Many applications are now available to buyers.
 - The software is of high quality.
 - Prospects know how to evaluate and select a system.
- Hardware manufacturer respondents do not see processing services companies or turnkey vendors as fueling the growth in turnkey systems.
- Hardware manufacturer respondents see two major limiting factors to the growth in turnkey systems:

- The prospect is not as sophisticated as desired to evaluate and select new systems.
 - More applications would sell more systems.
- The factors above can limit as well as fuel growth.
 - Hardware manufacturers indicated that prospects are much more sophisticated today than they were several years ago, but that more sophisticated buyers are desired. Hardware manufacturers would like to see more sophisticated prospects in the future.
 - According to hardware manufacturers, prospects limit the growth in the sale of turnkey systems because they lack sufficient knowledge of hardware, software and systems. Since prospect knowledge is greater today than it was several years ago, prospect sophistication fuels growth in turnkey systems.
- The variety of applications provided are another factor that both fuels and limits growth:
 - A large number of turnkey systems covering many applications are available to buyers. This fuels growth because prospects can find a system for their needs.
 - Hardware manufactureres believe that if more applications were available, more turnkey systems could be sold. Since demand for applications exceeds supply, this limits the growth of turnkey systems.
- Processing services respondents indicated that five factors were largely responsible for fueling the growth of turnkey systems:

- Prospects' increased ability to evaluate and select systems.
- High quality of systems.
- Ability of sales personnel to sell systems effectively.
- The wide variety of applications available to the user.
- Competition from turnkey vendors.

- It is not surprising to see that processing services companies did not rate lower system cost as one of the major factors fueling turnkey systems growth.
 - Processing services companies' turnkey systems have a substantially higher average price than other vendors' systems.
- Processing services firm respondents indicated that three major factors are limiting the growth in turnkey systems:
 - System quality; i.e., systems would sell more easily if they were of higher quality.
 - Shortage of effective sales personnel.
 - Lack of adequately trained and experienced technical personnel.
- Processing services vendors' sales personnel are both fueling and limiting the growth of turnkey systems.
 - The sales personnel selling turnkey systems are doing an excellent job in the eyes of their respective companies.
 - The problem is that there are not enough effective sales personnel available.

- Note that processing services company respondents do not presently view other processing services companies as fueling or limiting factors in the growth of turnkey systems. This will undoubtedly change in the future as processing services firms begin to compete for customers.
- Turnkey vendor respondents listed the greatest number of factors responsible for fueling the growth in turnkey systems:
 - Quality of systems.
 - Availability of many software systems.
 - Ability of prospects to evaluate and select systems effectively.
 - Hardware quality.
 - Low cost.
 - Ability of technical personnel to create systems that solve user problems.
- Turnkey vendor respondents see only one major factor limiting turnkey system growth:
 - The quality of the systems should be improved to generate more sales.
- Turnkey vendors see turnkey system quality as a help and a hindrance.
 - There are many systems available that have an excellent design and are easy for the user to implement.
 - However, there are systems available that are poorly designed and are extremely difficult for the user to implement.

- Turnkey vendors do not view processing services firms as being a help or hindrance to the growth of turnkey system sales.
- Overall, processing services vendors are not currently viewed as a major factor in turnkey systems. This is likely to change in the future.
- Hardware quality as an issue is becoming less important in the overall picture of turnkey systems. Hardware quality has a basically indifferent rating from all vendor types.
- It is surprising that vendors do not rate user training as a limit on turnkey system growth.
 - Other INPUT surveys found user training to be critical to the success or failure of a turnkey system installation.
 - Users are concerned with the quality of vendor-supplied education. Some of the education classes and instructors are excellent, but many are not.
- The factors fueling the growth of turnkey systems far outweigh the limiting factors. All respondents viewed the market as challenging; one where substantial growth opportunities would allow many different vendors to co-exist for the next five years.
- Turnkey systems are receiving much more attention today than in the past. The growth prospects for turnkey systems are excellent for the next five years, as shown, in the forecasts in Exhibit IV-3 and IV-4.
- Exhibit IV-5 reflects the importance of maintenance of hardware and software as a profit contributor to the types of vendors indicated.

EXHIBIT IV-3

MARKET GROWTH IN TURKEY SYSTEMS, 1978-1984

VENDOR TYPE	1978 (\$ MILLION)	1979 (\$ MILLION)	1980 (\$ MILLION)	1981 (\$ MILLION)	1982 (\$ MILLION)	1983 (\$ MILLION)	1984 (\$ MILLION)	AAGR 1979-1984 PERCENT
HARDWARE MANUFACTURERS	\$ 380	\$ 490	\$ 640	\$ 1,240	\$ 1,990	\$ 2,410	\$ 3,830	51%
PROCESSING SERVICES COMPANIES	71	110	555	1,110	1,990	4,290	6,130	125
TURKEY VENDORS	2,450	3,550	4,570	5,660	6,790	7,770	8,880	20
TOTAL	\$ 2,901	\$ 4,150	\$ 5,765	\$ 8,010	\$ 10,770	\$ 14,470	\$ 18,840	35%
SYSTEMS SHIPPED	43,000	61,000	85,000	119,000	159,000	214,000	279,000	35%

EXHIBIT IV-4

MARKET FORECAST BY COMPONENT, 1978-1984

SYSTEM COMPONENT	1978 (\$ MILLION)	1979 (\$ MILLION)	1980 (\$ MILLION)	1981 (\$ MILLION)	1982 (\$ MILLION)	1983 (\$ MILLION)	1984 (\$ MILLION)	AAGR 1979-1984 PERCENT
HARDWARE	\$ 1,731	\$ 2,410	\$ 3,210	\$ 4,320	\$ 5,570	\$ 7,160	\$ 8,880	30%
SOFTWARE	740	1,120	1,700	2,490	3,590	5,140	7,140	45
SERVICE	430	620	860	1,200	1,610	2,170	2,820	35
TOTAL	\$ 2,901	\$ 4,150	\$ 5,770	\$ 8,010	\$ 10,770	\$ 14,470	\$ 18,840	35%
SYSTEMS SHIPPED	43,000	61,000	85,000	119,000	159,000	214,000	279,000	35%

EXHIBIT IV-5

RATINGS OF MONEY-MAKING
FACTORS IN TURNKEY SYSTEMS

FACTOR	VENDOR TYPE			OVERALL
	HARDWARE MANUFACTURER	PROCESSING SERVICES COMPANY	TURNKEY SYSTEM VENDOR	
HARDWARE	3.6	3.4	3.4	3.4
SOFTWARE	4.8	5.0	4.6	4.7
HARDWARE MAINTENANCE	3.7	2.3	3.4	3.2
SOFTWARE MAINTENANCE	4.1	3.4	3.4	3.5
MARKETING	3.9	4.6	3.8	4.0
SALES	3.8	4.0	3.9	3.9
TRAINING	3.2	3.1	2.9	3.0
PROFESSIONAL SERVICES	2.6	2.3	3.0	2.8
COST CONTROL	3.4	4.6	3.6	3.8

NOTE: RATED ON A SCALE OF 1 TO 5, WHERE 5 = MOST IMPORTANT AND 1 = LEAST IMPORTANT

E. MAINTENANCE

- Maintenance is of paramount importance in turnkey system support.
 - If someone other than the hardware manufacturer sells the system, who performs the hardware maintenance and the systems software maintenance?
 - If hardware and systems software maintenance is performed by the hardware manufacturer, but the system is sold by a non-hardware manufacture, who should the user call if there is a problem with the turnkey system?
 - The user wants to call one number if support is needed. Users expect that the vendor providing support will solve the problem, whether it is in the hardware, systems software or applications software. The user bought a turnkey system and expects turnkey maintenance.
 - Hardware manufacturers clearly have an advantage over processing services companies and turnkey vendors in this area.
 - Processing services companies are beginning to deal with the central maintenance issue when selling distributed data processing products, such as user site hardware services and intelligent terminals.
- Maintenance on turnkey systems is performed by different vendor types. The maintenance must be performed on hardware, systems software and applications software.
 - The original hardware manufacturer performs the maintenance on nearly 70% of the hardware and 60% of the systems software, but on only 22% of the applications software.

- . Over one-half of the hardware manufacturing respondents look to turnkey vendors for applications software maintenance. This is an indication of the lack of applications software capability of these companies, as well as the lack of investment made in applications software by the manufacturers.
 - . Nearly one out of five turnkey vendors looks to hardware manufacturers for applications software support. In these cases, the turnkey vendors are acting as the sales force for the hardware manufacturer without being the manufacturing companies' employees.
- Turnkey vendors and processing services companies perform nearly 20% of their own hardware maintenance, nearly 40% of their own systems software maintenance, and over 75% of their applications software maintenance. A high proportion of hardware maintenance is performed by processing services companies and turnkey vendors.
- Over 85% of all processing services companies perform their own hardware maintenance. Given the small installed base of hardware of these companies, it would appear that this support function must be a drain on profits.
- Many of the turnkey vendors perform their own maintenance because of the mix of hardware that was included in the turnkey sale. For example, a processor from DEC is combined with a printer from Diablo and terminals from Hazeltine. In some cases, special adapters are made by the turnkey vendors to connect the hardware together. In these cases, the turnkey vendor must take responsibility for hardware maintenance.
- Third-party maintenance companies perform 14% of the hardware maintenance, but less than 5% of the systems and applications software maintenance.

- The logical market for a TPM resides in:
 - Small turnkey system houses that have unique, industry-oriented application packages that need nationwide service to achieve additional market penetration. Application packages have been developed for a number of unique sets such as medical/dental, veterinarian, local law enforcement, dietary, law court and pharmacy.
 - Information processing companies that are providing or intend to provide on-site hardware.
 - . Companies such as NCSS and ADP are offering on-site hardware. Since it is their first venture in providing equipment, the slow build-up of sales placements must detract from their operating profit.
 - . The environment of existing software packages determines and limits their hardware selection. In the case of NCSS, the equipment had to be IBM or compatible devices. The selection was Two PI, an OEM supplier with no field maintenance capability.

F. THE TURNKEY MARKET AND HONEYWELL

- A turnkey system is defined as a "package" of software and hardware that is intended to fulfill a user's specific application requirement.
- Turnkey systems are provided from a number of sources, such as hardware manufacturers and system houses.
 - The most recent type of vendor to enter this market is the information processing company providing on-site user hardware which is either compatible with its processing service computer or usable as an extension of its software packages.

- The user on-site hardware supplied by processing services companies provides a market for Honeywell OEM-TPM.
- The market meets all of the established selection criteria. Furthermore, it has an estimated growth rate of 125% AAGR through 1984.
 - The maintenance revenue for this sector is projected to grow from \$16 million in 1979 to \$122 million in 1984, with profits in the range of 15-20%.
 - Presently, only 14% of the hardware maintenance and 5% of the software maintenance is provided by TPM.
 - It is a new market area with few established patterns for marketing and service.
- These information processing companies need to:
 - Stay abreast of this new market trend.
 - Provide on-site hardware in concert with the geographic distribution of users' present and planned communication facilities.
 - Provide user training as well as field maintenance.
 - Retain a profitable operation while building a field service organization which, with a few exceptions, is not now in existence.
- This market is not dominated by any one processing services firm. The larger companies that are or soon will be include Tymshare, NCSS, MCAUTO, Boeing Computer Services and ADP.
- INPUT recommends the maintenance and service of on-site user hardware for information processing firms as a method of entry into the OEM-TPM market.

V COMPUTER-AIDED DESIGN AND
MANUFACTURING

V COMPUTER-AIDED DESIGN AND MANUFACTURING

A. DEFINITION

- CAD (computer-aided design) and CAM (computer-aided manufacturing) may be defined or described as:
 - A system that combines human skill, expertise and intuition with the speed and accuracy of a computer. (CAD or CAM)
 - A system allowing an engineer or a designer to create and modify designs on a CRT screen interactively with the assistance of a computer, thereby increasing productivity during of the design phase of production. (CAD)
 - A system designed to increase the productivity of the manufacturing process by allowing engineers to produce numerical control tapes for operating machine tools and assembly devices. (CAM)
- CAD/CAM systems are particularly useful in designing mechanical parts and systems, electronic systems, integrated circuits and printed circuit boards.

B. CURRENT STATUS AND TRENDS

- Computer-based graphic design systems have existed in one form or another for the past 20 years.
- The utilization of these systems has been limited by a lack of both software and adequate inexpensive hardware.
- After several years as an exclusive tool for large or exotic users (General Motors, Research, DOD and aerospace companies), the technology of the minicomputer coupled with software has produced a rapidly growing, specialized market.
- The market is dominated by small firms, as shown in Exhibit V-1.
 - Consolidated under "other" are IBM (which uses a software package from a vendor), CDC, McDonald Douglas Automation, etc.
 - As shown in Exhibit V-2, each of the six vendors has tended to specialize in specific major application areas.
- The market is "software-driven." Among the major vendors, only Computer-vision can be considered an integrated manufacturer of hardware and software.
 - The other firms use OEM-provided hardware, desiring to expend funds on software development as opposed to hardware.
- No doubt, with the growth projection for this market, several large integrated firms will enter the business providing considerable competition for the established vendors.

EXHIBIT V-1

CAD/CAM MARKET SHARE BY COMPANY

COMPANY	1978 REVENUE (\$ MILLION)	PERCENT OF MARKET	1979 REVENUE (\$ MILLION)	PERCENT OF MARKET
COMPUTERVISION	\$ 48	29%	\$ 92	33%
APPLICON	22	13	43	17
CALMA	27	16	39	14
AUTO-TROL TECH.	21	13	33	12
M & S COMPUTING	20	12	30	11
GERBER SCIENTIFIC	9	5	16	6
OTHER	18	12	22	7
TOTAL	\$165	100%	\$275	100%

MERRILL LYNCH ESTIMATES

EXHIBIT V-2

CAD/CAM MARKET SHARES BY APPLICATION FOR 1979
(\$ MILLION)

COMPANY	ME-CHANICAL	ENGI-NEERING	ELEC-TRONICS	MAPPING	OTHER	TOTAL
COMPUTERVISION	\$ 46	\$ 9	\$28	\$ 3	\$ 6	\$ 92
APPLICON	13	4	22	4	-	43
CALMA	9	3	23	2	2	39
AUTO-TROL	10	15	3	2	3	33
M & S	-	12	-	15	3	30
GERBER	15	-	-	-	1	16
OTHER	12	2	2	2	4	22
TOTAL	\$105	\$45	\$78	\$28	\$19	\$275

MERRILL LYNCH ESTIMATES

- Further trends in the market indicate the eventual development of:
 - Networking capability which will allow the present minis to support remote terminals as well as the present hardwired terminals.
 - Better software for 3-D mechanical design capability, which will also produce numerical control output tapes.

C. FORECASTED MARKET GROWTH

- According to industry sources, the market for CAD/CAM grew from \$38 million in 1973 to \$275 million in 1979.
 - The market is projected to grow to \$1.5 billion in 1984.
- There are an estimated 2,500 standalone systems installed with a value of \$750 million.
 - At \$300,000 for an average system, the potential market is projected at 20,000 systems with a value of \$6.0 billion.
 - Current projections place maintenance services at 8-12% of the purchase price of the hardware and/or software. It is projected that this will grow to 15-20% by 1984, which would produce a maintenance/service market of \$225-300 million.

D. DRIVING AND RETARDING FORCES

- The forces driving the market to such rapid growth are:

- Hardware availability at a reasonable price.
- The evolution of technology that created high resolution displays and plotters.
- The shortage of engineers. Productivity improvement of engineers may be as high as 10 times. At 2 times, a \$300,000 system may show a payback on an investment of two years based upon a reduced requirement of field engineers.
- The shorter development cycle which reduces costs and allows a "faster-to-market" capability.
- It is the best if not the only solution for complex designs.

• Some forces are retarding the market. For example:

- The market is software-driven and there is a lack of packages for many application areas.
- Several subprograms are available, but vendors have experienced difficulty in integrating these subpackages into the overall application routines.
- Vendors are seeking the proper trade-offs between "rigid" and "flexible" program packages. "Rigid" programs are easy to install, require less training, but are soon outgrown by the user, who, when gaining experience, desires to modify the program and do more. "Flexible" packages are more difficult to install, require more training, but allow the user greater freedom to modify.

- Due to rapid growth, vendors are doubling the field engineering force each year. Their ability to attract, train and retain field engineers has been a retarding factor in the sales placement of units.
 - . A leading investment banker report on Computervision stated that, "this (growth of the field service operation) has been a principal limitation to further growth in 1979."

E. MAINTENANCE AND SERVICES

- The growth of the market is being hampered by the need for field engineering coverage.
 - The window which allows small companies to dominate this market will be closing soon as larger, better-staffed firms enter the market.
 - The present vendors cannot afford the luxury of building their own field maintenance force due to the time required to achieve the staffing.
- This is a software and not a hardware market. The user selects the application package that best fits its requirements. The hardware and its vendor is immaterial.
- Inherent with expanded geographic coverage for maintenance will be the need to provide users with installation support and training.

F. THE CAD/CAM MARKET AND HONEYWELL

- The CAD/CAM market (which can be viewed as a subset of the turnkey system market) meets all of the selection criteria for an OEM-TPM situation for Honeywell.

- The market presently consists of six small vendor companies; however, larger firms can be expected to enter this area.
- The market is projected to grow from \$275 million in 1979, to \$1.5 billion in 1984.
 - By 1984, the maintenance/service portion of this market is projected \$225-300 million, from a 1979 estimated base of \$82-133 million.
 - The market growth restrained by the lack of field engineers.
- INPUT recommends CAD/CAM as an emerging market in need of competent field maintenance and service.
 - Due to the technical complexities of the equipment and software configuration, combined with vendors' desires to keep the software confidential, there has been very little OEM-TPM penetration of this market sector.

VI OFFICE OF THE FUTURE



VI OFFICE OF THE FUTURE

A. CHARACTERISTICS OF THE OFFICE AUTOMATION MARKET

- The office is defined as a place where managerial and administrative personnel interact with other groups that form a company. The "office of the future" is a concept relating to the potential, beneficial impacts of future technology on a company's internal interaction and productivity.
- The office of the future objectives are to:
 - Increase managerial effectiveness.
 - Increase white collar worker productivity.
 - Reduce office costs.
 - Reduce the volume of paper handled and stored.
- A totally integrated system for the rapid electronic flow of information is required to realize those objectives. The technology currently applied to processing information will be applied to communicating information.
 - Computers, office automation and communications are combined to form the integrated system.

- Flexible transmission networks to interconnect the subsystems are vital to this integration.
- The office is one business area where automation has accelerated up the flow of information and reduced the number of manual tasks, with the possible exception of typing.
 - Data processing has actually increased the volume of paper which must be read, handled and stored. Reading, paper handling and storage are usually manual operations.
- Unlike the computer and communications industries, the office automation industry is fragmented. No single vendor offers a totally automated office.
- Some vendors are now offering a combination of functions with a communications capability.
- An increasing number of word processing, digital PABX and other subsystems are being installed or actively considered.
 - This seems to indicate that the office-of-the-future concept is gaining widespread acceptance. It is not.
 - These installations are mostly task-oriented with little systems integration.
 - What is lacking at most installations is the communications interconnection necessary to integrate all the subsystems into a completely interactive system.
- Existing technology can be used to establish an integrated system, so technology is not an impediment. The impediment is people: management and clerical personnel.

- Managers do not see how the integrated system will increase their effectiveness. They often do not understand the technology and are far from eager to learn it.
- Clerical workers do not understand the technology and are afraid of it. They believe that at best they will have to learn new skills and at worst their jobs will be eliminated.

● Management's effectiveness could be improved with an automated office.

- They will have instant access and selective control of the information they need to form a basis for making decisions.
- They will be able to transmit their decisions selectively and simultaneously, without delay.
- Management spends 80% of its time communicating. An integrated system will expedite these communications.

● Clerical workers will have to learn new skills, but these skills give them upward mobility.

- New career paths will open up for them.
- Experience has shown that few if any jobs have been eliminated by office automation. Fully integrated offices could change this in the future.

● There is a direct relationship between the capital equipment investment per employee and the productivity per employee.

- The capital equipment investment for the average secretary is \$3,000.

- The capital equipment investment for the average production worker is \$25,000.
- In 1978, \$762.5 billion was spent to support 45 million white-collar workers. Ninety-one percent of this money went to salaries and wages.
 - Personnel costs for white-collar workers are increasing 22% annually.
 - Increasing productivity can reduce these costs.
- According to government statistics, fewer people will be entering the labor force during the balance of this century.
 - The labor pool annual growth rate will decline each year until approximately 1995.
 - Fewer people will be available for office staffing.
 - Labor will become more expensive because of its scarcity.
- The ratio of electronics technology costs to physical labor costs is becoming more favorable to electronics every year. The cost of technology (all-inclusive) is falling 22-30% annually, while labor rates are climbing 8-10% annually.
- The volume of paperwork is increasing 12% annually. An annual increase of only 8% in labor costs brings the total annual increase of handling paper to 20%.
 - Eighty percent of business correspondence could be handled by electronic mail services.

- The savings in paper and labor costs might justify the cost of source document and computer output microfilming without reference to the savings from reduced storage space requirements.
- The cost of electronic and magnetic storage will soon decrease to the point where these media are cheaper than paper for many applications.
- Telecommunications facilities are expected to have an average annual growth rate of 12% through 1990, while the cost per message continues to decline. The 1979 cost of \$1.25 per message for computer-based message systems will decline to \$0.50 per message by 1982.

B. CURRENT MARKET STATUS AND TRENDS

- Office automation functions are aimed at:
 - Reducing the volume of paper handled and stored by U.S. business establishments.
 - Increasing white-collar productivity.
 - Increasing the speed of information transfer by using electronics or optical technology.
- A number of market offerings are profiled below:
 - I. ELECTRONIC MAIL SERVICES
 - Electronic Mail Services (EMS) transfer documents and messages by electronic transmission over voice-grade telephone circuits.

- There are four types of electronic mail systems available today:
 - Facsimile: A system for transmitting words and images. Pictures are scanned and converted to signal waves which are transmitted to a remote point where they are reconverted to produce a duplicate of the original. There are nearly 180,000 units installed to date.
 - . Examples of new facsimile devices are:
 - Xerox Telecopier 485 (less than one minute per page transmission).
 - Qwip 1200, and Qwip 2 (two minutes per page transmission).
 - Graphic Sciences, Inc. (GSI), offering a range of low end to high-end facsimile units.
 - Panafax MV 1200.
 - Public or Private Teletypewriter Networks: A terminal-to-terminal form of communications. The TELEX/TWX network is a public network available through Western Union. There are about 130,000 TELEX/TWX terminals installed to date. Private teletypewriter networks are used by many large companies. There are over 100,000 terminals attached to these private networks available through telephone operating companies and Western Union.
 - Communicating Word Processors: A basic word processor with added transmission capabilities. Many communicating word processors have multiple workstations using shared logic and handle a document base in conjunction with communications. There are approximately 15,000 communicating word processors installed to date.

- Examples of communications word processors are:
 - Wang's Office Information System (OIS) 145, which has an array of telecommunications options.
 - Datapoint's "ARC" distributed processing network, which can be tied into its phone management system, "Info-switch." Word processing software is available.
- Computer-Based Message Systems: Interactive message systems which are completely user-oriented. The software packages can be tailored to the users' specifications. There are about 15,000 CBMS terminals installed to date.
- Examples of systems available from timesharing computer companies are:
 - Tymnet's "On Tyme" public service electronic message services. The average cost per short message is \$0.30-0.40, a full page is \$1.25. This service is available in 100 cities where Tymnet nodes are located.
 - Corporate Time Sharing Service's Global Electronic Mail (GEM) timesharing service via Telenet's public packet network.
- An example of a CBMS network for private, intra-company use is Computer Corporation of America's COMET system. This message service is offered as a dial-up service at \$1.50 per message, including terminals and average usage. The COMET software can also be purchased for in-house installation at about \$40,000.
- Distribution/Mail List Management (D/MLM) services are performed by an application software package. The function

manages the automatic updating for repetitive printing and mailing of documents.

- D/MLM can be implemented on in-house computers or word processors.
- D/MLM is also available from many remote computing and batch computing service bureaus. Occidental Computer System, Inc.'s "Super Mailer" is an example. It is a mailing list processing and management system.
- Another type of message system in common use is available from companies that offer computer processing services. Messages are sent between users of the services on a network.
 - There are thousands of terminals that have been used for this purpose at one time or another.
 - Few of these terminals are dedicated to message systems, but can function in that capacity when desired.

2. SOURCE DOCUMENT MICROFILMING AND COM

- Source document microfilming and computer output microfilming (COM) are separate services, but they use essentially the same equipment. This area offers tangible savings to the user over conventional paper use.
- Source document microfilming is an automated function which microfilms incoming paper messages and internal documents for permanent record storage and audit trail. COM does the same thing with computer output information.
- Source Document Microfilm and COM equipment is available from:

- Kodak - Komstar Microimage Processor.
- 3M - System 700S.
- Datagraphix COM.
- Prices range from \$75,000 to \$150,000.
- Micrographic services are available from computer services vendors such as:
 - Computer Micrographics, Inc., a nationwide network of micrographics service centers.
 - U.S. Datacorp, the largest service company in the COM field. U.S. Datacorp also supplies turnkey COM systems.
 - Zytron, a subsidiary of National CSS, Inc., a rapidly growing COM services company.

3. INFORMATION RETRIEVAL SYSTEMS

- Information retrieval allows direct terminal access to specific data or information elsewhere, such as correspondence and document files or data bases. Information storage and retrieval software package systems are available for a variety of applications. They are supplied by a large number of software and service bureau companies, such as Informatics, Mathematica, National CSS and Tymshare.

4. OPTICAL CHARACTER RECOGNITION SERVICE

- Optical Character Recognition (OCR) service is the optical transcription and/or translation of pre-printed bar codes or type fonts. OCR is used for high-speed data collection and data entry to central computers, intelligent terminals and word processors.

- Recognition Equipment, Inc., is the largest supplier, providing high-speed document readers to the U.S. Postal Service, large banks, insurance companies and other large companies.
- Scan-Optics, Inc., Scan-Data, and Optical Business Machines offer high-speed page and/or document readers to many companies in banking, retailing and manufacturing.
- Several OCR manufacturers are interfacing OCR readers to word processing equipment. Included are CompuScan, Hendrix Electronics and the Context Division of Burroughs.

5. CORRESPONDENCE CONTROL SYSTEMS

- Correspondent control systems are software packages providing indexing for future retrieval to provide action files, reminders, automated tickler files and scheduling or "calendaring." Examples of correspondence are:
 - Credit and loan tracking systems offered by services companies to banks and lending institutions.
 - An insurance company with correspondence control integrated into its DP policy management system.
 - A manufacturing respondent will be implementing a correspondence control capability in-house using records storage via the word processors.
 - A large remote computing services company has configured a comprehensive correspondence control and data base package for a financial institution which was already a client.

6. DATA BASE SERVICES

- Data base services involve the maintenance and storage of dedicated application or special-purpose data base information; e.g., an economic data base or a parts inventory data base. Examples of data base services follows.
 - Bank customer records, credit reporting and appraisals services are obtained from outside computer services vendors.
 - An insurance company example is a respondent with a consolidated data base file for insurance policy holders and a file for current payments. These are available on an in-house central computer.
 - A manufacturer uses an outside data base service for medical and chemical statistical information.
 - Data bank services are available from a number of private companies, government agencies and non-profit organizations. Examples are Lockheed's DIALOG data bank of over 80 data bases, and Interactive Data Corporation and Chase Econometrics, in business and finance.
 - Data base management systems software is available from many vendors for implementation on in-house computers. An example from Cullinane Corporation is Multiple Computer Support which allows a user to configure a shared data base between two or more IBM and/or compatible CPUs. Features include dynamic scheduling and automatic recovery.

7. WORD PROCESSORS

- Word processing is the text preparation, formatting and error-free retyping of final copy from stored (removable) media. There are now nearly 200,000 word processors installed. Today word processors fall into four generic types:

- Non-display, standalone electronic typewriters with removable storage media. Ninety-five percent have no ability to communicate and account for 80% of the installed base. Examples are:
 - . IBM Mag Card typewriters.
 - . Redactron's early models.
- Display standalone units, some with communications capability. Examples are:
 - . Lexitron, early models.
 - . IBM System 6.
 - . Xerox 850.
 - . Wang Laboratory's WPS5.
- Shared logic, minicomputer-based systems with multiple work stations and, normally, CRT displays. The minicomputer handles communications and maintains a document base. Examples are:
 - . Philips Electronics Ltd. - Micom-2001.
 - . NBI, Inc. - Paperwork Processor.
 - . AM Jacquard Systems - AMtext 100.
- Hybrid information processor systems used for both word and data processing. Examples are:
 - . Basic Four - Dataword. A small business computer with a word processing software package.

- Wang Laboratory - Office Information Systems (OIS) 125, 130, 140, 145.
- CPT Corporation - CPT 8000 and Wordpak.
- IBM - OS6.
- 3M - System 84.
- Four-Phase Systems, Inc.
- Datapoint Corporation.

- All shared logic, hybrid word processors, and an increasing number of display standalone processors have communications capabilities. These are known as communications word processors (CWP). They can be interfaced to, and communicate with, a variety of other equipment used for office automation functions or business communications. Examples of communications word processors are capable of interfacing to::
 - A central computer.
 - Facsimile equipment.
 - OCR equipment.
 - COM equipment.
 - Central dictation systems.
 - Image printers.

- Photocomposition and phototypesetting equipment.
 - Remote computing services.
- CWP's are also capable of performing other automated business functions, including:
 - Electronic mail services.
 - Distribution/mail list management.
 - Information retrieval functions.
 - Correspondence control.
 - Data base services.
- Word processing and text editing services are available through a number of remote computing services companies, such as Tymshare and Bowne Information Systems.
- Word processing services companies are relatively new. However, a few already have a national network of service centers available.
 - These word processing companies offer numerous document processing and handling services using advanced office automation equipment.
 - Software application packages are often available for data base management, personalized correspondence and other services, such as photocomposition.
 - Examples of word processing services companies are Keyboard Communications, Inc., and the Cyberway Division of Bowne Information Systems.

8. PHOTOCOMPOSITION AND PHOTOTYPESETTING

- Photocomposition and phototypesetting automation is the computer-based preparation, composition and formatting of material for camera-ready copy printing. Computer-based photocomposers and phototypesetters are available from several manufacturers, including:
 - AM International: Varitypers' Comp-Set and Comp/Edit.
 - Compugraphics: Edit Writer 7500; MDT350 area composition system.
 - IBM Electronic/Selectric Composer.
- Commercial printing and publishing companies offering these services are available in all but the smallest towns and communities. Generally, they are local businesses whose territorial coverage can offer one-day pickup and delivery.
 - An example of an area service bureau is ADAPT, Inc., Automated Documents and Photo-Typesetting. Its services include word processing to phototypesetting, and phototypesetting from computer tapes.
 - An example of a nationwide printing and publishing company is Arcata Graphics, with numerous local service centers offering computer-assisted photocomposition, typesetting and a range of printing techniques.
- Other important aspects of office automation are addressed in this report, including:
 - Interconnect and the PABX.
 - Trends in communications as they relate to the total package for user improvements.

- The role of mini/microcomputers.

C. VENDORS OF OFFICE AUTOMATION EQUIPMENT

- Office automation hardware vendors and computer services vendors are gradually heading towards office-of-the-future information processing networks.
- Every vendor currently serving the market plans to continue to do so.
- Manufacturers using the same automated systems technology to serve other markets are adapting their products to serve the business communications market.
 - Word processing is often the first office function to be automated.
 - IBM introduced automatic typewriters in 1964. Today they still dominate the market, with installed magnetic card and magnetic tape selectric typewriters (MT/ST).
- Independent word processing or small business computer manufacturers entered into the word processing market in the early 1970s. Many of these have been acquired by the mainframe manufacturers. For example:
 - Burroughs acquired Redactron.
 - 3M acquired Linolex.
 - AM International acquired Jacquard.

- Raytheon Data Systems acquired Lexitron.
- Exxon Enterprises acquired Vydec.
- Management Assistance, Inc. (MAI) acquired Wordstream.
- Independents that have not been acquired and are doing very well include CPT, Inc.; Wang Laboratories; and NBI, Inc.
- Traditional office system suppliers such as Xerox Corporation and Lanier also offer word processing systems.
- Minicomputer manufacturers have also entered the word processing market, such as Digital Equipment Corporation (DEC) and Data General.
- Manufacturers of systems used for distributed data processing are now offering word processing and other office automation function capabilities. Datapoint Corporation and Four-Phase, Inc. are already involved, and Hewlett-Packard soon will be.
- IBM has brought out newer standalone, systems, notably System 6, which do well replacing older installations.
 - IBM has nearly 80% of the total word processing installed base. These are predominantly standalone non-display devices.
 - IBM is expected to maintain an average annual unit increase of 20-25% by introducing communicating word processing capabilities.
- The independent companies are gradually reducing IBM's installed base market share and are rapidly increasing their own share of annual shipments. The current annual growth rate is 30-40%.

- Wang Laboratories \$322 million fiscal 1979 revenues included \$93 million for office system products. The company experienced a 62% total sales increase over 1978. Currently, Wang's word processing system shipments are increasing at a 150% annual rate. They introduced their word processing system in 1976.
- Wang's most recent product announcement, the integrated information system, combines word processing, data processing and telecommunications within the same system. Wang's steady introduction of new information processing functions assures it of a continued high growth rate of at least 50% per year for the next several years.
- Wang is rapidly becoming a significant factor in the office automation market.
- Lanier is a relative newcomer to the word processing supplier market. After many years as a dictation equipment manufacturer, Lanier introduced a word processing system about two years ago. The system contains a product manufactured by AES Ltd. of Canada which owns 36% of Lanier.
- Lanier's AES word processing system places it among the top five in the industry, not far behind Wang in number of units shipped. Lanier's revenues were \$184 million in fiscal 1979, up 42% over 1978. The growth is primarily due to word processing sales. Its new Wordplex, a shared logic system, is a step towards distributed word processing and product innovation.
- Lanier is expected to continue its high growth rate of 35-40% per year for several years.
- CPT, Inc.'s \$34 million 1979 revenues, all coming from word processing, show a 70% increase over 1978. Revenues for 1980 are estimated at over \$50 million. CPT focuses on smaller cities and smaller companies.

- Xerox Corporation is currently shipping over 850 word processing units per month and will be pushing that rate up to 1,000 per month. Xerox word processing systems are expected to grow at 20-25% annually over the next few years.
- IBM remains number one. However, in display device unit shipments, Wang is far ahead.
- Increasing one's individual market share is difficult in a market which is increasing annually at 30-40%.
 - Candidates with strong potential for market gains are AM International (Jacquard), Raytheon's Lexitron Division, Digital Equipment Corporation, and MAI's Basic Four/Wordstream.
- Companies with related office automation products are developing packaged systems built around their products. More companies are introducing multi-function systems (MFS). The most common are combinations of data and word processing with communications capabilities included.
 - DEC was the first, followed by several independents; e.g., Wang, AM International, MAI, Inc. IBM has also entered this field.
 - The majority of other suppliers will follow the trend toward integrated communicating information processing.
- Between 1978 and 1984, communicating word processors will have the most rapid growth of all word processing systems.
 - Prior to 1978, fewer than 5% of the total word processor installations were communicating word processors. By 1984, they will approach 40% of the total installations.

- Many vendors view communicating word processors as the backbone of intra-company electronic message services.
- The major advantage of communicating word processors is the potential of adding functions such as:
 - Electronic mail services.
 - Correspondence control.
 - Distribution/mail list management.
 - Information retrieval.
 - Data base services.
- Facsimile equipment has been around since the 1920s, when it was primarily used by news and wire services. Business use began in the 1960s.
 - Business now accounts for 80% of all facsimile use.
 - Until recently, Xerox held a 45% share of the installed base of facsimile units. Graphic Sciences and 3M shared another 25% of all installed units. The balance was shared by at least a dozen other vendors.
 - The facsimile market picture is changing. New entrants such as Qwip and Panafax in the "two minute" market are gaining ground and each is capturing at least 10% of annual shipments.
 - Rapicom (merger of Rapifax and Dacom) is currently the leader in the high-speed (two minutes or less) facsimile market. Its product allows store-and-forward multiple addressing, and alternate communications over public-switched networks.

- Graphic Sciences, Inc. has a full range of facsimile products. It is in an excellent position to increase its 12%-plus share of the market.
- Xerox is trying to maintain its facsimile market dominance with new, faster units introduced over the past year. These new products could help maintain and possibly increase Xerox's present market share.
- IBM has developed a new data compression method for digital facsimile. It will transmit a page in about one minute. The method is under consideration as a worldwide facsimile standard by the CCITT. If this happens, IBM could make a sizable penetration into the worldwide facsimile market.
- Compression Labs, Inc. has developed a new data compression technique facsimile. It is based on a patented coding scheme called Character Symbol Matching.
 - . The coding scheme combines the earlier Run Length Coding (RLC) and Optical Character Recognition to produce five times more efficiency than the RLC compression technique.
 - . It is a store-and-forward facsimile message switch with inter-machine and teletypewriter compatibility. The "black box" can be added onto current, slow facsimile equipment for store-and-forward functions.
- The bulk of electronic message services is the over 200,000 teletypewriter terminals furnished by telephone companies and Western Union.
- TWX/Telex transmission speeds are slow for today's requirements. However, replacing them with faster devices is costly, and will be very gradual.

- . It is possible that new installations will keep up with retirements for quite some time.
- Computer-Based Message Systems (CBMS) are the ultimate in interactive message systems. These high-speed systems are user-oriented and very efficient. However, they are also very expensive. The number of installed subscriber terminals is estimated to be 15,000 at the end of 1979.
 - Suppliers of CBMS services by public access systems include:
 - . Tymnet - "ON TYME."
 - . Scientific Time Sharing - "MAILBOX."
 - . Compuserve - "PLEXUS."
 - Computer Corporation of America supplies its "COMET" CBMS system for private, intra-company networks.
- The market is approximately evenly divided between public and private suppliers. The market, in terms of subscriber terminal installations, is expected to grow at a rate of 100% per year through 1982.
- Computer Output Microfilm (COM) processing is used by approximately 30,000 U.S. companies. Only 10% of these companies own their own equipment.
 - Ninety percent of all COM processing is done by COM service companies. The largest of these are U.S. Datacorp and Zytron (now part of National CSS). Another nationwide micrographics service company is Computer Micrographics, Inc.
 - U.S. Datacorp and Zytron also install turnkey COM systems, primarily for customers who have been using a service company and whose

processing has increased to over 300,000 frames per month (an industry rule of thumb for purchase cost justification).

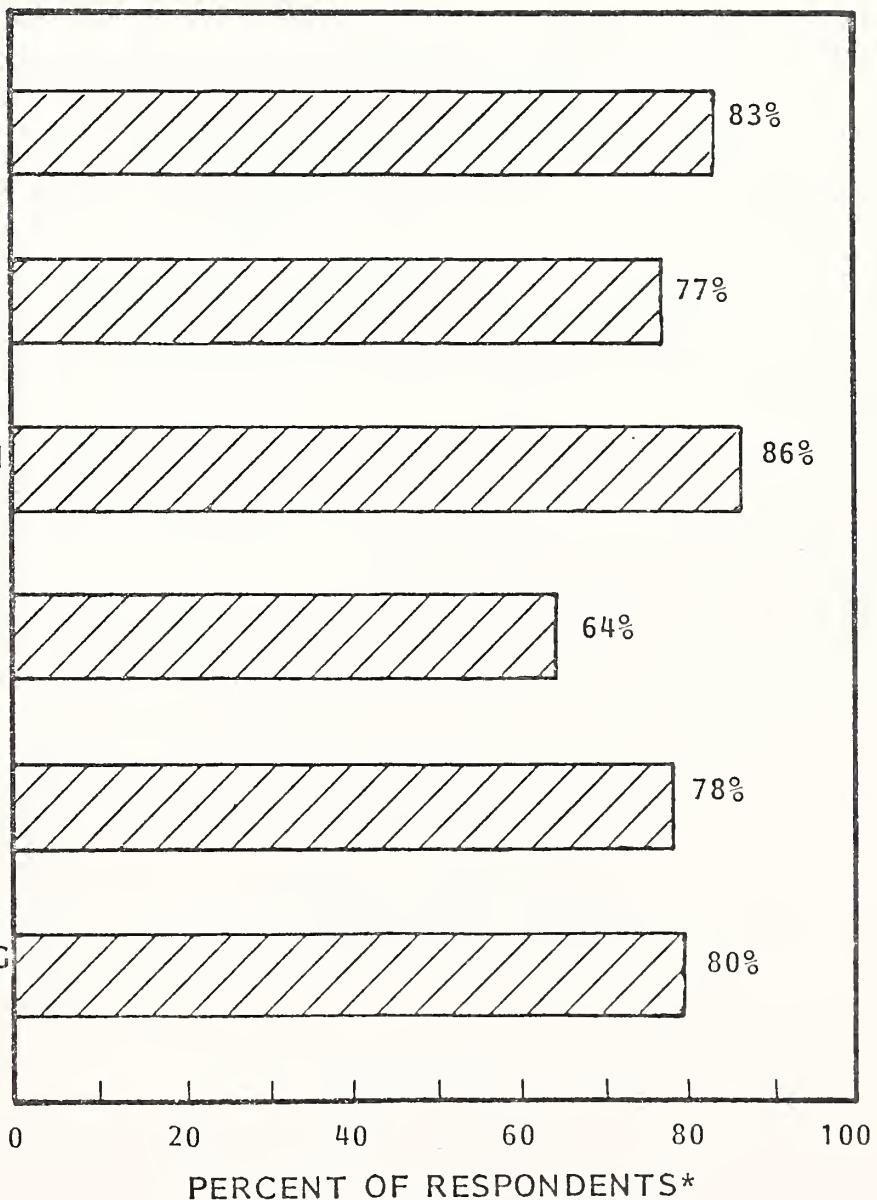
- Major suppliers of COM equipment are Datagraphix, Kodak and 3M.
- A minor supplier, Quantor, is now owned by NCR.
- COM equipment may be used for source document as well as computer output microfilming.
- The combinations of equipment are endless; hence, for the purpose of this study, they were limited to:
 - System #1 - A small business computer with the added functions of text processing.
 - . A logical entry for companies such as IBM, NCR, DEC and MAI.
 - System #2 - A shared logic, multistation text processor with added data processing functions.
 - . A logical entry for companies such as Wang, 3M, Burroughs/Redactron.
 - System #3 - An office copier system with added facsimile and output printing functions.
 - . A logical entry for companies such as Xerox, Kodak and IBM.
 - System #4 - A PABX system with added data or text processing functions.

- A logical entry for companies such as Northern Telecom and ITT.
- System #5 - A communications network system with added information processing functions.
 - A logical extension to service for value added carriers such as Graphnet, Telenet and Tymnet (if regulatory agencies allow).
- System #6 - A timesharing system with added communication services.
 - A logical offering for companies such as GE, National CSS and Tymshare (if regulatory agencies allow).
- The users' overall response to multifunction systems is presented in Exhibit VI-I by equipment type.
 - The System #1 concept based on small business computers, is well accepted by a large number of users. It is considered most useful at remote locations in a decentralized data processing environment.
 - The use of a System #1 at remote locations could be beneficial to both corporate headquarters and the remote site. The information processing load at the corporate data center could be reduced and information for exclusive use at the remote site could be more rapidly processed.
 - The System #2 text processor concept is acceptable to a fairly large number of potential users. It could be particularly valuable for users with high-volume document production.
 - These systems are far more valuable if they can communicate with the corporate data processor and with each other. They are useful in either a centralized or decentralized environment.

EXHIBIT VI-1

ACCEPTANCE OF MULTIFUNCTION SYSTEMS AND SERVICES (BY SYSTEM)

- SYSTEM #1 - SMALL BUSINESS COMPUTER WITH ADD-ON TEXT PROCESSING
- SYSTEM #2 - TEXT PROCESSOR WITH ADD-ON COMPUTATION
- SYSTEM #3 - COPIER WITH ADD-ON FACSIMILE AND OUTPUT PRINTER
- SYSTEM #4 - PABX WITH ADD-ON COMPUTATION AND TEXT PROCESSING
- SYSTEM #5 - COMMUNICATIONS NETWORK WITH ADD-ON INFORMATION PROCESSING
- SYSTEM #6 - TIMESHARING WITH ADD-ON COMMUNICATIONS SERVICES



*PERCENT OF ALL RESPONDENTS WHO WOULD CONSIDER BUYING SUCH A SYSTEM (COMBINED DATA PROCESSING, COMMUNICATIONS AND OFFICE SERVICES RESPONDENTS)

- The System #3, copier-based concept is viewed with the highest degree of acceptance by all information processing users interviewed (although the difference from other systems is not great).
 - . The copying and facsimile capabilities both have applications throughout the corporation.
 - . It is considered capable of immediately diminishing paper processing and distribution problems.
- The System #4, PABX-based concept is slightly less readily accepted than any of the other systems. However, it is well accepted, particularly by communications managers.
 - . Generally, it is not easy for most users to see text or computational capabilities linked to a PABX system.
 - . Communications-oriented users could visualize a PABX-based system with additional capabilities, particularly for text processing.
- The System #5 concept, based on communications networks concept, and the System #6 concept, based on timesharing services are both readily accepted by almost all users. The FCC regulatory limitations were not addressed. However, if the FCC permits combining voice networks and data processing systems, most corporations will be ready to go with the combination.
- The overall reaction of these large users portrayed a positive attitude towards multifunction equipment.
 - It may reasonably be assumed that several vendors are preparing multifunction equipment for announcement.

D. MAINTENANCE AND SERVICE

- No one vendor offers all of the devices required for the office of the future.
 - Because of the mix of vendor equipment, a niche should exist to provide TPM for a variety of devices which would also allow one point of contact for users of multiple-vendor equipment.
- The fledging office-of-the-future market is presently dominated by full-service companies such as IBM, Xerox and Exxon.
 - However, the market is growing so rapidly that even a 5% market penetration provides a significant business.
 - Word processing devices are forecasted to become a \$6 billion market by 1984. A 5% penetration of a \$600 million to a \$1 billion maintenance market would still produce significant revenues.
- While the market projections are large, it is a very difficult area to penetrate: with a few notable exceptions, the maintenance and services functions are awash with red ink.
- The market is emerging but not yet fully defined.
 - However, communications will become the backbone of this market. Communications represent the missing link required to tie together the existing devices into a true system.

E. THE OFFICE-OF-THE-FUTURE MARKET AND HONEYWELL

- The "office of the future" as a TPM does not offer an obvious market for Honeywell.

- The market is dominated by IBM, Xerox and Exxon which control over 70% of the market and do not need or use TPM.
- The market is growing at an extremely rapid rate; however, a clear-cut contender has yet to surface to offer either a challenge to the big three or a TPM opportunity for Honeywell.
- Companies that provide TPM in this market are doing so at less than 15% pre-tax profit (and in several cases are incurring losses).
- Due both to the domination of this market by three large firms and to marginal profits, INPUT recommends that Honeywell not consider this market as an OEM-TPM opportunity.

VII MAINTENANCE IN THE DATA
PROCESSING INDUSTRY

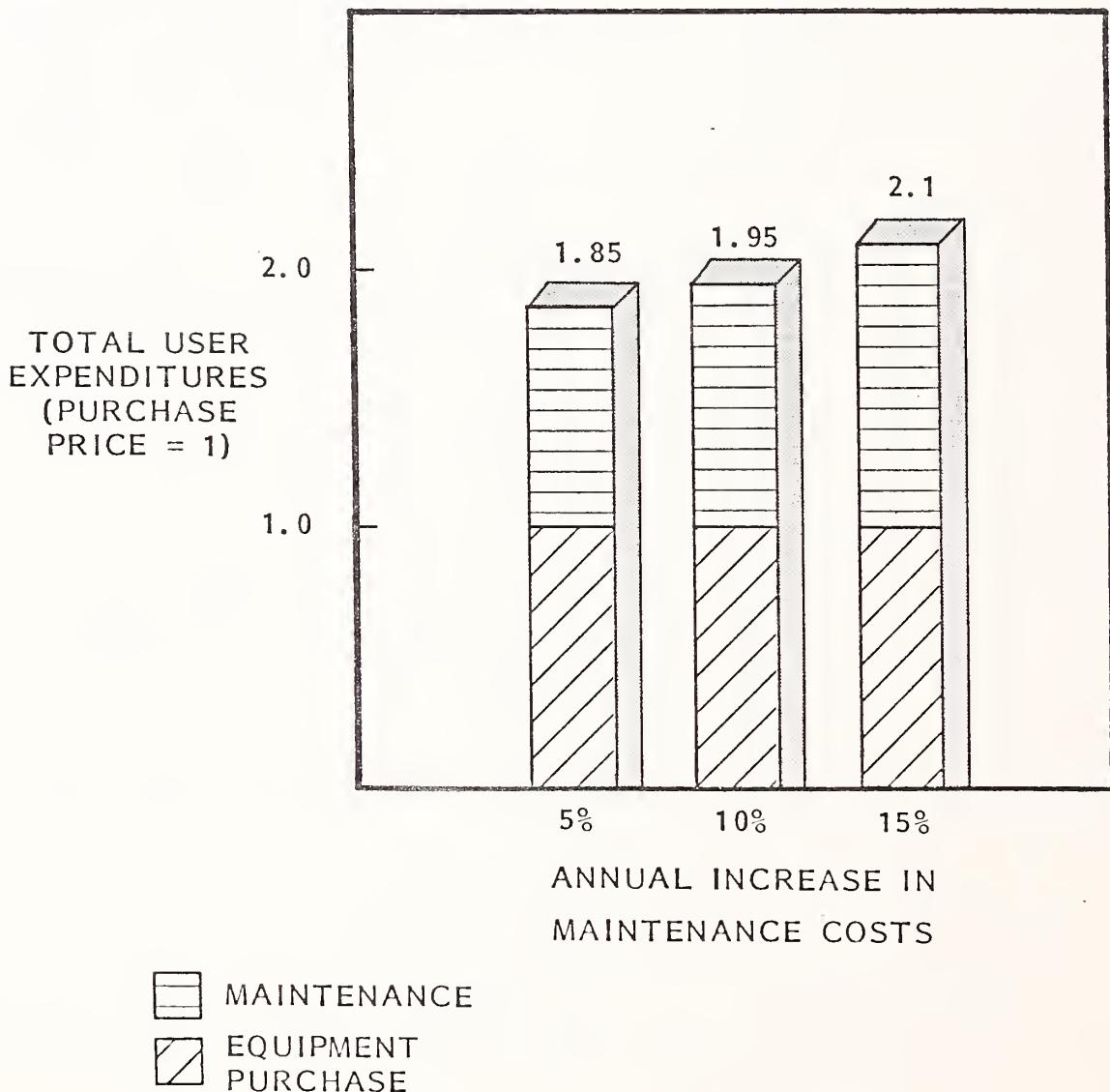
VII MAINTENANCE IN THE DATA PROCESSING INDUSTRY

A. SERVICE IS A BUSINESS

- Over the past two years, general management in the computer industry has given increasing recognition to service as a major business opportunity.
 - Over 90% of the computer industry's vendors either operate field service as a P&L center or expect to do so within two years.
 - Vendor companies are structured such that the senior field service executive reports directly to the company's CEO, group general manager, or Senior Vice President of Marketing.
- Over one-half of the industry field service heads have a Vice President or Senior Vice President title.
- The fundamental reason for this change in attitude and direction is clearly shown by the example illustrated in Exhibit VII-1 which shows the ratio between hardware and service revenues over the seven-year life cycle of a typical system.
 - Clearly, users are really making a financial commitment to service as large as or greater than their commitment to hardware.

EXHIBIT VII-1

TOTAL USER SYSTEM EXPENDITURES
OVER A SEVEN-YEAR LIFE CYCLE



NOTE: CHART ASSUMES IN YEAR 1 THAT MAINTENANCE IS 10% OF PURCHASE PRICE

- An even more dramatic example is shown in Exhibit VII-2, which shows that over a five-year life, maintenance is expected to account for from 40% to 49% of a user's expenditure for an IBM 8100 system -- a new product based on (relatively) state-of-the-art technology, presumably offering high reliability, sophisticated diagnostics, simple repair procedures, fully debugged software, etc.
- There are other underlying reasons for this enhanced recognition of service as a product. Three of the more important ones follow:
 - Diminution of hardware costs due to technological and manufacturing advances are beginning to limit the margins that can be achieved through hardware sales. As hardware prices will decrease faster than the market will grow, suppliers must seek new avenues for profit.
 - Buyers are beginning to perceive that service, not hardware, is the primary item that distinguishes one vendor from another.
 - The costs of labor and of maintaining and distributing spares are rising very rapidly. This situation tends to focus attention on obtaining an adequate return on investment for service functions.

I. HISTORICAL PERSPECTIVE AND DRIVING FORCES

- The concept of service as a product is not a new one. Indeed, it has been well accepted by the consumer marketplace for a long time.
 - Sears, Roebuck and Company, for example, has clearly demonstrated the success of the concept. Originally touted as "we service what we sell," as an aid to selling goods, its service and spare parts division have long been among the firm's most profitable operations.
 - General Electric has established service divisions for both consumer and industrial products not directly coupled to its manufacturing groups.

EXHIBIT VII-2

USER COST DISTRIBUTION OF
TYPICAL IBM 8100 INFORMATION SYSTEMS

COST DISTRIBUTION ITEM	SMALL CONFIGURATION (\$180,000*)	LARGE CONFIGURATION (\$310,000*)
PROCESSOR, MEMORY AND DISK	16%	19%
TERMINALS	11	19
PRINTERS	14	13
TAPE DRIVES	7	3
MISCELLANEOUS FEATURES AND ADAPTER	3	6
SOFTWARE MAINTENANCE	27	15
HARDWARE MAINTENANCE	22	25
TOTAL	100%	100%

*COST OVER 5-YEAR LIFE

SOURCE = VENDOR WATCH REPORT "IMPACT OF THE 8100"

- GM's "Mr. Goodwrench" campaign has been extremely successful.
- The federal government has given increasing recognition to unbundled service by purchasing more and more service (as a product) from the private sector. This has spawned new companies specializing in service and has given increased recognition of the concept to established hardware vendors looking for a bigger "piece of the action."
- The information processing industry has been dominated by IBM (computers), Xerox (office products) and AT&T (communications). All three have traditionally taken a "bundled" approach to service and, as such, have established de facto standards and umbrellas under which the rest of the industry believed it had to operate.
- Led by IBM, which by its recent actions appears to be moving towards separating service from hardware, the industry is beginning to see the old (perceived) constraints crumble.
- As computer/communications systems become more complex and more important to the everyday conduct of an institution's business, the sensitivity to "down systems" is intensified. An increasing number of users cannot tolerate the loss of the use of a system for any extended period. In this environment, service becomes an imperative that can be justified at nearly any price.
 - This sensitivity is the principal inhibitor to the acceptance of the "office of the future"; i.e., systems designed to handle data processing, word processing, communications, electronic mail, etc. Few users can tolerate a system outage that would terminate all of these functions simultaneously.

2. THE OPPORTUNITY

- In 1980, service in the U.S. EDP industry alone will account for approximately \$6.5 billion in user expenditures. (To place this figure in perspective, it is

approximately twice the size of the entire U.S. commercial semiconductor market.)

- As equipment becomes inherently more reliable, the absolute value of the cost of service will decrease. However, it is neither likely nor necessary that they decrease in direct proportion to the reliability of the device or system.
- With the growing recognition (by users) of the importance of service and the ability of the suppliers to provide better maintenance aids, there is increasing acceptance of the concept of user participation in the service function. Suppliers are beginning to sell:
 - Training.
 - Instrumentation.
 - Documentation.
 - Spare parts.
 - Redundant equipment.

B. IMPLICATIONS OF MANAGING FIELD SERVICE AS A BUSINESS

- The continuing shift to profit center operation, along with more senior reporting of management, implies several major changes in the way field service organizations are managed. Both field service and corporate executives need to have a clear understanding of the implications of these changes and a common sense of priorities as newly formed plans are implemented.
- The issues of greatest concern in this context are listed below and described in subsequent paragraphs:
 - Change in the treatment and control over field service revenues.

- Performance ultimately measured by return on assets.
- Senior management organization structures.
- Increased emphasis on productivity.
- Marketing and sales.

I. REVENUE TREATMENT

- The immediate result of transferring any operation from a cost center to a profit center is that division management is suddenly concerned with the revenue term of the profit equation.
 - Management will be fighting for revenues. Arbitrary allocations to service will not, and should not be, acceptable.
 - There will be much more "push" on the part of field service to cut deals more favorable to them. Field service management will have "sign-off" authority on all customer arrangements and will be able to reject or veto contracts not deemed to provide the proper return to the service division, regardless of the potential benefits to marketing or manufacturing operations.

2. RETURN ON ASSET PERFORMANCE MEASUREMENT

- P&L center managers are often measured by return on assets. In the field service business, the assets are not spares inventories.
 - Management will be constantly pressed to reduce inventory and to keep financial carrying costs under control.
 - . The cost of carrying inventory is critical, typically on the order of 30-40% of inventory value. Interest, space, handling, rate of obsolescence, transportation, insurance and taxes are all soaring today.

- Perhaps the greatest challenge to management today is to stabilize inventory costs and to reduce them if possible, while providing adequate customer service - all in the face of shorter and shorter equipment life cycles.

3. ORGANIZATION

- With P&L responsibility, the field service executive is a member of an exclusive team, the other members of which will frequently have conflicting objectives. For example, the field service executive will be threatened by:
 - The marketing division, because of the revenue implications.
 - The manufacturing division, because of the spares inventory implications.
- In order to prevent being "whipsawed" by divisional transfer costs, the field service division requires all of the organizational elements of a complete business, including:
 - Finance.
 - Marketing.
 - R&D.
 - MIS.
 - Personnel.

4. PRODUCTIVITY

- The shortage of skilled personnel has been discussed many times in earlier INPUT studies and will not be dealt with here, except to state that the situation is as bad or worse than predicted. Thus, the pressure to prove

productivity is intensifying and is particularly acute in the P&L organizations. There are a few clear trends beginning to emerge that address the productivity problem, all of which should be considered. They are:

- Remote diagnostics.
- System support centers.
- A more active role of field service in product design, QC and QA.
- Intensive training of first-line managers.
- Greater use of built-in test devices.
- Enhanced internal diagnostics.
- Restructured personnel deployment.
- Encouragement for users to participate in maintenance and installation.

5. MARKETING AND SALES

- As noted in Section 3 above, implementation of an effective marketing organization is a necessary element of the field service P&L organization. One of the principal reasons it is needed has to do with the failure of the traditional hardware marketing organization to recognize and deal with the duality of the field service/customer interface.
 - The FE deals almost exclusively with the customer's operations people.
 - The buying decisions are made by senior executives whose contact is limited to hearing about problems (the system is "down"), and reviewing the budget (maintenance costs are going up). They rarely, if ever, hear about successes.

- The field service organization needs to develop reasons to interface with the decision makers. They need to get their "story" across in a dynamic and effective manner.
- The field service marketing organization should be chartered with responsibility at both the pre-sale and post-sale levels. In other words, a sales brochure won't do the job. An ongoing information program designed to keep decision-makers involved in the plans of the service organization and to explain their meaning in terms of the future relationship is required. Examples of material appropriate in this context might be:
 - "Our remote diagnostics program and how it will improve your uptime."
 - "Our maintenance philosophy for systems being used in a DDP environment."
- A corollary to the establishment of such a marketing program is that FE managers must be trained to feel comfortable dealing with senior customer management and must be endowed with the necessary presentation and other communications skills.
- Field service should adopt "account strategy planning" for all significant or potentially significant customers. Elements of individual plans (which should be living documents) would include, for example:
 - Identification and ranking of all potentially significant customer contacts, including ultimate users.
 - Pricing and contracts.
 - Short-term objectives.
 - Long-term marketing/sales objectives and implementation strategy.

- Milestone specifications.
- Identification of potential problems and plans to deal with them if they arise.

C. CONTRACT TRENDS

- Users continue to prefer fixed-fee maintenance contracts over T&M by more than a 20:1 ratio.
 - However, there is a definite trend toward reducing base coverage to prime shift and purchasing additional coverage as needed on a T&M basis.
- There are several emerging trends that are beginning to influence the composition of service agreements:
 - Increased customer involvement in diagnostic, repair and installation procedures.
 - The shrinking physical size of some equipment, which makes depot maintenance practical for a much greater number of devices.
 - The emergence of retail outlets, owned by both vendors and third parties.
 - More widespread use of remote diagnostics and system support centers.
- Because of these influences, some important changes in the service contract will be made.

- Vendors will be forced to provide much more flexibility.
- Service agreements will be tailored to meet the specific needs of individual, large customers.
- A choice of standard plans will be available for the smaller user.

- Within ten years, nearly all post-warranty service will be unbundled, reflecting general recognition of service as a product.
 - Incremental pricing will be standard. Although it is not widely used today, the industry is beginning to see experiments by industry leaders, particularly IBM, that point to much broader use in the future.
- Hardware maintenance costs (in relation to the installed base), which will continue to increase over the next three to four years, will begin to reduce after that time.
 - Service costs relating to software maintenance will continue to increase for the foreseeable future.
 - Thus, the total cost of service as a percentage of income derived from the sale of a system is expected to increase.

D. PERSONNEL CONSIDERATIONS

- Recruiting continues to be the number one problem reported by field service managers.
 - A very large percentage of companies do not have the personnel problem in proper perspective.

I. SALARY AND INCENTIVES

- In contrast with the results of INPUT's 1978 study findings, some companies are making a determined effort to boost the morale of field service personnel.
- Some companies have instituted incentives. Schemes in force include:
 - A percentage of maintenance contract renewals paid out as bonuses.
 - Each quarter, an outstanding FE is given a week's trip to a resort.
 - Commissions paid on the sale of supplies and spares.
 - Periodic bonuses awarded for "plus" performance.
 - Commissions paid on service contracts and training courses sold.
- Interestingly, most of the companies offering incentives are small (less than \$150 million annual sales) and in the main are headquartered on the West Coast. Employee turnover in these firms is low by comparison with others.
- One very large company had an incentive scheme whereby selected FEs were able to attend 100% club parties. This experiment turned out to be counter-productive because selection standards were subjective and not fairly applied.
- As would be expected, there is a direct inverse correlation between salary and turnover.

2. SOURCES OF PERSONNEL

- As shown in Exhibit VII-3, there has been some shift in thinking between 1978 and 1980. Most vendors perceive that the majority of new field service people will, in future, come from trade schools and from the ranks of those having no prior technical training or skills.

EXHIBIT VII-3

RATINGS OF PRIMARY SOURCES OF NEW FS PERSONNEL

VARIABLE	YEAR			
	1978	1980	1982	1985
HIRE AND TRAIN (NO TECHNICAL PRE-TRAINING)	2.0	1.8	2.8	3.5
RECRUIT FROM COMPETITION	3.0	2.9	2.8	2.1
RECRUIT FROM INDUSTRIES	2.3	2.1	2.6	2.4
TRAIN DISCHARGED ARMED SERVICES PERSONNEL	2.6	2.5	2.4	1.9
RECRUIT FROM OTHER FUNCTIONS WITHIN THE COMPANY	2.7	1.9	2.5	2.2
TRADE SCHOOLS	2.9	3.7	4.0	4.1

(SCALE: 1 = LOW, 5 = HIGH)

*1978 & 1982 RATINGS FROM "MAINTENANCE REQUIREMENTS FOR THE INFORMATION PROCESSING INDUSTRY, 1978-1983"

- This implies a relatively major investment in training facilities.
- "Recruit from competition," although decreasing in importance, remains a relatively important source of new people.
 - This industry-wide problem is obviously self-defeating and needs to be dealt with at the industry level. Forums such as the Association of Field Service Managers could serve as a vehicle to initiate industry-wide discussion that could lead to some resolution or at least improvement on this matter.

3. SERVICEPERSON-OF-THE-FUTURE TRENDS

- By the mid-1980s, the service organization will evolve into a three-tiered structure. At each level, different types of people will be required to meet the service demands of the integrated computer/office/communications systems in place at that time.
- Within this hierarchy, each level has its own role in the service organization, performing different functions and interfacing with customers in different ways and often at different levels (i.e., the skills, training, handling and compensation requirements will be significantly different for each category).
- Due to economic necessity, some of the functional requirements of the three levels may overlap, depending on customer base, product line density, geographic dispersion of specific products and other factors. In most organizations, however, the lines will be distinctly drawn.
- The three classes of service personnel and their distinguishing characteristics are described as follows:
 - a. Local Field Service Technician (LFST)
- LFSTs exist primarily to handle routine service functions such as:

- "Cookbook" PM diagnostics and routines.
 - Repair at the module or unit replacement level.
 - Cleaning and burnishing of mechanical components.
- Skill and technical training requirements for LFSTs will be relatively minimal.
 - A high school education will be sufficient.
 - Since they interface directly with customers, appearance and communications skills will be important attributes.
 - This category will be largely nonexempt and will be the area within the field service organization most susceptible to union encroachment.
 - Coincident with a heavy influx of this new class of employee, companies will need to have programs in place to detect and train those individuals capable of progressing beyond this basic level.

b. Local Field Support Specialist (LFSS)

- LFSSs serve as backup to the LFSTs, taking charge of problems they cannot deal with. They must have a thorough grounding in theory of operations of the systems with which they will come in contact.
- Most positions will require the equivalent of a four-year degree. Most will need to comprehend both software and communications.
- LFSSs will be generalists capable of making decisions on non-routine problems as they come across a broad spectrum of products and systems.

- LFSSs are professionals in the usual sense of the word. They need to look and act like professionals.
 - In many organizations, LFSSs will serve an important role in field service marketing and sales. They may, in fact, have responsibility for the creation and sale of maintenance programs for individual customers.
- c. Central Site Support Specialist (CSSS)
 - Central site support specialists are resident at headquarters or regional locations and are responsible for dealing with highly technical problems beyond the capabilities of field personnel.
 - CSSSs are specialists in every sense of the word. They have in-depth knowledge of specific products. Indeed, their knowledge may be limited to an individual subset of a complex system; i.e., the central logic unit, or the operating system software package.
 - In-house training will frequently include participation in the system design, development engineering or software development teams originally responsible for a product.
 - It will be extremely difficult to retain these people in the same job for long periods of time. Field service should be prepared to staff these positions on a rotating assignment basis.

E. THIRD-PARTY MAINTENANCE (TPM)

- INPUT feels that the time has come to expand the traditional definition of third-party maintenance services. There are, in fact, two types of TPM. One is a viable, long-term business opportunity; the other is not.

- TPM firms which rely on contracts to provide maintenance on obsolete equipment and/or mixed-vendor installations exist largely because the manufacturers want them to exist.
 - . Their only competitive edge is price.
 - . The equipment suppliers could drive them out of business overnight if they chose to do so, simply by making it difficult to obtain spare parts.
 - . Another way to preclude end-user TPM is to prevent the TPM vendor from being able to maintain software.
 - . INPUT has coined the term "end-user TPM" to describe this business.
- The second class of TPM business involves the establishment of long-term contracts between a TPM firm and a manufacturer wherein the TPM firm agrees to handle all of the maintenance of a product or product line within a prescribed geographic territory (which may be national or even international).
- In this situation, the TPM vendor becomes, in effect, a partner of the manufacturer.
- INPUT has coined the term "OEM TPM" to describe this business.
- In contrast to end-user TPM, OEM TPM is an emerging new business opportunity. There are several premises upon which the business can be approached:
 - Offering services based upon specialized expertise; CAD/CAM, communications systems, knowledge of specialized process environments, etc.

- Offering services based on geographic distribution.
- Offering services based on extensive, available facilities such as repair depots, automatic test equipment, warehouse locations, transportation facilities, communications networks, etc.

- OEM TPM is receiving increased attention from major vendors, both as buyers and sellers.
 - Some of the industry giants are seriously considering awarding OEM TPM contracts on some of their smaller product lines.
 - A few of the same companies are seriously considering entering the OEM TPM business in certain geographic areas.
- A new phenomenon that may impact the TPM business over the next few years is the interest evinced by a few large users in getting into the business.
 - A large aerospace company which maintains its own systems is now offering end-user TPM in a limited geographic area.
 - A large bank which maintains its own office equipment is seriously considering the creation of a subsidiary which would offer both end-user and OEM TPM services.
- TPM accounts for less than 10% of service expenditures today; however, OEM TPM is growing rapidly. This growth is inherent in vendors' markets where:
 - The products are mainly software-driven.
 - Value added is secondary to the hardware provided or produced.
 - The product is new and exciting and the marketing effort will be compromised by the lack of field maintenance.

VIII RESPONDENTS' COMMENTS

VIII RESPONDENTS' COMMENTS

- This section covers the more relevant aspects of the respondents' survey responses.

A. INTERCONNECT

- The accepted method for marketing is via exclusive/nonexclusive distributors.
- Major names in the market may or may not manufacture their own equipment.
 - RCA and ITT sell OKI.
- The manufacturers are not interested in TPM or direct sales (typical of the Japanese effort in the U.S. for non-consumer goods).
 - The quality of the end user sales and service will become a problem as the PABX moves into the "office of the future." The devices will have to be sold into a more complex environment, and maintenance response will fall into the same area as data processing (i.e., 2-3 hours as opposed to "tomorrow").
- A large distributor (defined as \$10-30 million in total revenues) usually is confined, by choice, to one geographical area.

- This is a problem in selling large national accounts as it relates to installation and service.
- Compath in Oakland, California is defined as a large distributor.
 - It provides equipment from Rolm, Tele/Resources and Iwatsu.
 - Sales and service are rendered from 12 offices, all in California. Total employment is 350 people.
 - A three-hour response time (MTTRs) is guaranteed by contract.
 - . Service is normally rendered on one shift for five days. Three-shift, seven-day coverage is available for additional rates.
 - . User remoteness that precludes three-hour response requires a special contract.
 - The company is private, so financials are not available. The company stated a 1980 revenue projection of \$30 million (versus \$20 million last year) of which \$5.5 million is maintenance revenue.
 - . Maintenance as a percentage of total revenue; at eighteen percent is well below the industry average of 31%.
 - . The company estimates \$600,000 in profit (11%) from maintenance and service. Had they achieved the industry average, the profit number would be much higher.
- Compath is not interested in TPM as they have established service and fear a TPM would take over sales of a product and become a competitor.

I. RESPONDENTS' COMMENTS ON INTERCONNECT

- "Compath is a distributor and maintenance is a prerequisite to getting this status. Vendors want to ensure good service by compelling the distributor both to sell and support the client."
- "Maintenance is currently profitable."
- "Want to perform (maintenance) in-house, would not want their (TPM) to become a competitor eventually - take over accounts."
- "Little training is required with this equipment."
- "Do not want to lose control of the maintenance activity. Third party would buy direct from manufacturer's anyway."
- "Have always give via the distribution network. Service has always been a problem, but given the business and money situation, it was the best they could do."
- On advantages for using a TPM:
 - "Uniform service over part or all of the nation. Large companies deal with only one service vendor instead of many. Be more competitive with Bell in the service department."
- "The interconnect business is very new, like the computer business was in the 1950s. Manufacturers are cash short and forced to deal via distributors. Users are not sophisticated and are wary of the interconnect vendors. Equipment was originally designed by computer people without good communications background. It has tended to be over sophisticated and not reliable. Manufacturers needed money up-front and released marketing rights to distributors. Business could not support the expense of a good quality third party."

- "Given the circumstances, distributors worked adequately. Each sale was tough, and the distributor had to be flexible. Often service and training were below par because of the need to keep the price down. People who ran voice communications were wary of non-ATT equipment just as people were wary of non-IBM machines."
- "Situation in the industry is changing rapidly. Distributors now are much larger and stable. Service is better but still varies by area. Distributors mark prices up from 100% to 200% depending on the market. They usually must stay 10-15% below the ATT price."
- "People from a data processing background are coming into control of voice communications. They are more open to interconnects but more demanding of service. They want standard service of 2-3 hours maximum. As the PBX becomes more key (as with hospitals, brokers, etc.) maintenance is more important. This has put pressure on the distributor but also opened greater opportunity."
- "OKI was not interested in taking over its own sales effort and contracting out for maintenance. The capital expenditures to do this were too great, and the risk involved unacceptable. They did not want to start competing with their own distributors and drive down the price nor eliminate the distributor and go it alone. Buying the distributors was out of the question."
- "OKI was open to adding another large national distributor. RCA and ITT currently compete in many, but not all, national markets. A truly national distributor would please large clients and bring in new ones. National accounts are hard to get when sold/maintained by more than one distributor. The closer a distributor can look like ATT in sales and service, the more successful it will be."
- "Problems would include competing with other distributors and training personnel. OKI gives no exclusive distribution rights. Training is strictly paid by the new distributor. Start-up would be expensive."

- "OKI sees the market booming in the next five years. They are committed to distributors for the present. Currently, a \$10-30 million distributor is very large."
- "Large national accounts often balk at having to deal with many distributors for maintenance. One national vendor would be desirable. Traditionally, the larger companies have done the best (RCA and Universal Communications)."
- "Large distributors can justify and absorb a loss in a city until enough equipment installed to be profitable. Small companies can't do it. If the distributor can sell the user other products as well, it can better justify the maintenance investment."
- There are now four key markets for interconnect equipment:
 - Hotel/motel.
 - Hospitals.
 - National accounts.
 - One-shot operations.
 - . Hospitals and hotels can be sold much more equipment.
 - . RCA especially sells TVs as well as telecommunicators. There is a definite market for environmental and security systems in these areas. Also, laundry machines, computers, cash registers, etc. These users often would rather deal with one vendor than many. With good name recognition, these are often long-lived accounts.
 - . National accounts also have large-scale needs. Most find interconnects too much trouble. With a national organization this

would be alleviated. These also have diverse needs for environment/security control, etc.

- Small accounts can be sold by anyone and have no advantage in a large vendor except in very remote locations."
- "With more sophisticated PBX, distributors with network skills will be desirable - better to compete with ATT."
- "Distributors currently use a 50-250% markup on products, usually what the market will bear. Much of this can be lost when the walls turn out to be concrete not particle board when installation time comes."
- "The 'automated office' will make service even more important. With EDP people making decisions, maintenance will have to be good. If the whole office stops, you damn well better fix it fast."
- "They doubt OKI would ever have the resources to pay for it (maintenance). OKI does not see ever being in the service business."
- "OKI markets and services equipment solely through a network of distributors. Some such as RCA Telephone Systems (part of RCA Service) and ITT are national, many are only regional. For distributors the profit is mostly in the products' lease or sales rather than in service."
- "Service provides some revenue but is performed as a consequence of sale and to ensure the contract for expansion and upgrade."
- "OKI will not contract a distributor without assurance of some minimum amount of service capability."
- "Distributors grow as their installed base grows. They must be where the machines are, regardless of how remote."

- "Hitachi currently markets its products only via distributors. There is no direct end user sales effort. Quality of distributor varies, some good, bad, indifferent. They try to be selective, but take what they can get."
 - "Distributor success depends on size. In big cities they do well, elsewhere not well. Someday (we) may use direct sales/third party to go into remote areas."
- "Service is profitable, so they do not complain. Their records are not well kept and they do not know exactly what parts are best, but no problem."
- "Users would probably like using a major vendor, but it would not be the key to a buy/not-buy situation. From the user's viewpoint it would be nice but not required, from ours it would be very dangerous."
- "With better RD (i.e., better equipment) the capability to use less skilled people increases. Will then be easier to establish new offices and hire more people rather than use a third party."
- "Compath is really already a third party and using another maintenance group would be competitive. To give them the parts would qualify them to compete directly in maintenance with the distributor."
- "Maintenance is not profitable in the telecommunications interconnect industry. The business is total chaos, and most people have no idea. There is no such thing as strategy or planning. Profit/loss centers are unknown."
- "Typically, the sales price covers: (from the distributor)
 - OEM
 - Sales cost, overhead, interest
 - One-third.
 - One-third.

- Margin

- One-third.

- "Maintenance is a pain and no one makes any money at it."
- "Distributors typically need to undercut the ATT price by 15%."
- "All the business is modelled after ATT just as computer business is after IBM - that tells you a lot about the business."
- "If T/M only, then profitable - contracts are rarely profitable."
- "Distributors make a profit on maintenance concern that response be good - if not then use telco which is everywhere."
- "Distributors getting more profitable all the time."
- "Do own maintenance in NY/NJ; use dealers and distributors elsewhere. Have coverage throughout the U.S. Market currently in 50 cities."
- "Typical system 100 stations cost \$1,000/station. We charge \$3.00 per telephone/year maintenance."
- "Began as a distributor for other equipment, then decided to make our own."

B. COMMUNICATION

- The acceptable method for ground-based satellite systems marketing is for the manufacturer to sell directly to the U.S. Government, common carriers and large users.
 - The vendors prefer not to deal with end users, regardless of size, as they must provide maintenance support.

- The vendors provide second-level technical support for field service.
 - This pattern will begin to change as the market grows and field service support will be required by the manufacturers. The growth of CATV and other applications (Holiday Inns has ordered 125 earth stations as a trial for room TV and video conferencing) will force a field service operation.
- Companies that supply only U.S. Government and other foreign military or security groups were not considered in this report.

I. RESPONDENTS' COMMENTS ON COMMUNICATIONS

- "As Kentron International, Cable and Wireless installs, maintains and operates satellite earth stations. [We] work primarily for common carriers and exclusively out of the U.S. [We] currently operate stations in 23 countries."
- Com Tech Laboratories: "Market only to common carriers who do their own maintenance. FS is available on T/M daily rates only. Have no significant remote diagnostics. Products are warranted for one year. Currently have 150-200 systems installed."
- "SBS is not hurrying or cutting corners in its development or operation. The three partners (IBM, COMSTAT and Aetna) have put up the cash needed to do it right. Immediate profitability does not seem to be of any real importance."
- "SBS has designed earth stations for constant monitoring. Redundancy has been built into the system to prevent as many outages as possible. Monitoring and remote diagnostics will be run from the network control center in McLean (VA). There are currently four operations and maintenance facilities spread over the country. These will be responsible for the actual repair of equipment. The plan is for redundancy to alternate the need to have FEs available at all times to all places. Spare parts will be stored at the O&M locations."

- "When users have a problem, they call the network control center. The NCC runs diagnostics and isolates the problem. NCC contacts the appropriate O&M locations and an FE is sent. After swapping the lowest replaceable unit, the O&M sends the faulty parts to depots located in as yet undetermined locations. Depending on the criticality of the failure, SBS plans to guarantee a one and one-half to two hour response."
- "If the (SBS) system comes up as planned they will be pressed for trained service personnel. Training takes about six months and the first group finished only this year. There are currently five clients planning to begin usage in 1981. In the next two years they hope for from 400 to 600 earth stations, all initially manned. They plan to cover them 15 of the 21 shifts in a week. This will require approximately 1,200-1,800 FEs in the next two years for earth stations alone."
- "There will be as many O&M centers as is necessary to provide two-hour response. SBS hopes preventive maintenance, constant monitoring and redundancy will keep the number of emergency on-site calls (and with this the number of FEs needed) to a minimum."
- "SBS sees no usage of third parties. The training required is intensive and they want people dedicated to SBS alone."
- "SBS will be high technology and completely on-sited for third-party maintenance."
- "With the NCC (network control center) the need for FEs in an absolute sense will stay down. With more users the actual need will go up."
- "Building the FE force will be hard but SBS can do it better than any third party."

- "There will be adequate installed density to make FS profitable by 1985."
- "No vendor could service this equipment without months of training and experience. Third party is not viable for this system."
- "SBS plans a full-service maintenance offering. The user will not be involved in the maintenance process in any appreciable way. All field personnel are carefully trained in system architecture and repair. Earth stations are designed to operate unattended but will be manned initially. On-site support will be phased out as all diagnostic options become available and equipment is demonstrated as functional. SBS does not plan any use of third parties for maintenance. They feel such third parties are inadequate to their needs due to: 1) nature of the equipment 2) the eventual density of equipment and potential revenue to be made. If SBS is as successful as they plan, equipment will be densely enough installed to make the maintenance operation highly profitable."
- "In four years, SBS sponsors have committed over \$375 million."
- "First (SBS) satellite to be launched October 1980. First earth station field trials scheduled for early 1981. SBS plans for both user dedicated and user shared earth stations."
- From SBS: "Satellites built by Hughes Aircraft Company. They were to be launched on the NASA space shuttle but due to delays will be conventionally launched."
- "Tracking, telemetry and command facilities built at Castle Rock (CO) and Clarksburg (MD). Equipment was made by Nippon Electric and COMSAT."
- "Earth station components are built by Hughes Aircraft (radio frequency terminals), Fujitsu, Ltd. (time division multiple access modems), IBM (satellite communication controllers), and NIPPON Electric (port adapter systems)."

- "Scientific-Atlanta (GA) currently considers service a cost center. They are about breaking even at present. They do not have ambition to make it a great profit center in the future."
- "Scientific-Atlanta manufactures a complete earth station installed by very large communications vendors. Earth stations can cost over \$500,000 each depending on custom requirements. SA currently has from 25-30 clients worldwide. Users such as Southern Satellite, RCS and Bell Telephone can do first-line maintenance themselves. They prefer to rely on their own resources rather than the vendor. These typically buy and stock their own spare parts, calling the vendor only in extreme circumstances. In this case vendor support is time and materials only."
- "Service is centralized in Atlanta. If SA performs all maintenance there is usually on-site support. All other maintenance is negotiated and depends on required response time, in-house support available, geographic location, etc. As such, there is no zone surcharge and distance to Atlanta is not a critical factor."
- "The market for earth stations has changed in the last two years and will continue to make drastic transformations. Until recently only very large satellite and communications vendors bought earthstations. These could perform their own maintenance and FS only provided background support. For these an FE rarely went on-site. If a problem developed, new modules were usually sent and swapped by the user. Spare parts were both purchased by users and stored at regional depots. Users typically had the capability and preferred to service their own equipment."
- "With the advent of digital communications the market changed. Non-communications vendors began coming into the market. These used earth stations as a port to another vendor's satellite rather than to their own satellite. These users typically could not/would not perform their own maintenance. SA now services those directly themselves. Whenever possible, SA forces the user to participate in module swapping and local diagnostics. No

standard agreement is available and SA will guarantee no specific response time."

- "Maintenance at Scientific-Atlanta is not geared toward the newer type of user. Though support is provided, it is not the full-service maintenance provided by computer manufacturers. Users take what is available and are grateful. SA does not plan to significantly expand its FS organization. Via a combination of remote diagnostics, better equipment and user repair, they plan only marginal FS growth. They say they do not plan to be a big maintenance vendor but rather an earth station manufacturer."
- "SA foresees even greater change over the next five years. With more vendors like Satellite Business Systems and Xerox offering satellite links to any sized user, the demand for small, simple earth stations will explode. By 1985, there will be so many installed that SA maintaining them will be impractical. After design flaws are eliminated, SA predicts the unit will be easily repaired by local depots rather than on-site repair. Users will be able to swap some parts but most problems will require FS support."
- "SA does not want to maintain all this equipment. They are not overly ambitious in this area and would rather give away the headache. RCA service has approached them about being a third party but were rejected. SA felt they were not good enough and that the current base could be adequately maintained. When SA moves into the mass market they will consider using outside people to help with marketing and support."
- "Scientific-Atlanta is very fixed in its ways. Rather than build its own marketing and service aims to sell into the 1985 mass market, they would prefer to contract it to someone else. SA is in the manufacturing business and that is where they intend to stay."
- "RD (remote diagnostics) will help cut the need for FS people but in the communications environment many will still be required. With large numbers of systems, large numbers of FEs will be needed."

- "By 1985, large numbers of stations in non-sophisticated locations will be installed. Need someone to help with service."
- "They (TPM) are not as good (as required) with communications and microwave problems and diagnostics."
- "Major vendor (TPM) could provide the coverage needed for the mass market and also provide the sales/market required. This combination would be good. Also the effort would be international so the vendor should also be."
- "(MCI) would like the option to use a third party as a temporary stop gap that could be replaced with MCI people at our option."
- "Microwave Network (MCI):
 - Terminal stations: 51, located one per city serviced.
 - Repeater stations: One every 22 miles throughout the network.
 - Junction stations: 12, are big repeater stations located where network lines cross.

Each station is made of different combinations of equipment from Collins, NFC, Fujitsu, Siemens, Comtech, etc.

Each terminal station has 6 FEs assigned for repair. Junction station has 3. Repeater station has one per 6-8 stations."

- Perceived advantages to use a TPM are: "Less costly (no overhead, vacation pay, sick time). Flexible (can cover areas with small demand, more people available). Easy to add new locations."
- "MCI sells only service. The network must be working and dependable to make any money. They feel they must provide the maintenance themselves to

ensure this. They just don't feel comfortable giving such a key element to someone else."

- "Only perhaps in a very remote area they do not plan to cover immediately. They will not use a third party in a large way regardless. Will bring in third party experts to trouble shoot remote locations on a per call basis occasionally."
- "There is a Richardson, Texas support center which clients call when there is trouble. Texas runs what isolation/diagnostics are available, then dispatch a local person. [The] network support center monitors system status. All equipment has fault alarm gear to notify Texas of a pending outage. They can repair equipment often before it breaks down. Newer equipment can identify more specifically which part in the unit is faulty. This will somewhat decrease the need for people in the field. However, the PUC requires service people to be licensed, so skill level will not fall too far."
- "Maintenance is not visible to the user. As long as the network is working, user does not care. Having a big name maintenance company would have no effect."
- "Due to rapid growth, MCI's biggest problem is recruiting new FEs. They have an extensive training program but still have problems. Usage of third parties will be mostly due to inadequate personnel."

C. RESPONDENTS' COMMENTS ON OFFICE EQUIPMENT MARKET

- The companies interviewed enter the market directly or via dealers.
 - The direct approach includes a mix of their own maintenance force and TPM.

- The dealers provide service.
- Generally the comments concluded that maintenance was profitable, although there is not a large amount of money involved.
 - Percentage of purchase price for annual maintenance ranged from 8-12%.
- The more aggressive companies (i.e., Exxon and Textron) have reserved certain cities to provide direct sales/service.

I. RESPONDENTS' COMMENTS

- Perceived reasons by Lanier to use TPM: "Can get maintenance going quickly in a new location. Don't have to service unprofitable locations."
- "Third parties are for companies which cannot sell/service their equipment. Service is key to good continuing business and a major revenue source. Companies with cash problems or very marginal financials will use distributors and third parties because they have to, not want to. At Lanier they make money on service and have no intention of giving it up to a third party. Since they ensure only overnight support, servicing remote locations is not too big a problem."
- "Third parties cannot give the same service as someone from the manufacturer's organization. They have incentive and dedicated skill."
- "Maintenance is a profit/loss center at Lanier. For service contracts only, there were \$17 million in revenues, compared to \$130 million total revenues (13%) overall, therefore maintenance is profitable."
- "Lexitron: 21 offices, 22 dealers. Maintenance: Indeserv, 4 offices; Raytheon, 3 offices; dealers, 22 offices; user, 2 offices, for a total of 31 Lexitron markets primarily to Fortune 500 national accounts. They will

service and install in any part of the U.S. They service the top 80 cities either themselves or via a third party and contract dealers in all others."

- "Lexitron uses Raytheon terminal services people in cities where they have coverage. All others not covered by dealers in via Indeserv."
- "Raytheon has the Raytheon Service Corporation subsidiary which is a third-party maintenance organization. Lexitron does not deal with them since most of Rayser's business is with the military in large-scale systems. These are out of Lexitron's product area. Lexitron also stated Rayser was trying to cut-back their coverage and services."
- "Indeserv takes 85% of each maintenance contract. The remaining 15% covers repair, training, publications, etc. Fees are per customer only, not dependent on number of users per city. Lexitron about breaks even on this arrangement. They feel Indeserv makes about a 10-15% margin on the service."
- "Indeserv is a cooperative of local field engineers and small third parties. They are skilled and professional. They want the business and are eager to do a good job. They are easily trained and already can repair other vendors' integrated in the system (Qume and Diablo printers). They are often better than Lexitron's own FEs. They have low overhead and can work for a minimum fee."
- "Their biggest machine has 8 boards. They are working on RD and will have it soon. Already two users (Hawaii) do their own service. Lexitron leases them spare parts and gives system support center advice at one-third regular fees. With National Accounts there is often skill to repair by user. Usage of third parties will not change. The skill level will decrease and it may be only board swapping, but some service must be available."
- "If they (user) want big names (TPM) they buy equipment from a big name. They buy Lexitron for cost and performance. Service is important but would

suffer under these. They would be second class citizens. Present arrangement works fine."

- "Lexitron is currently using money on its maintenance operation. They service more cities where the installed base is too small to break even than ones that are profitable. They service cities which have potential even at a loss. They hope within two years to make service to profit center."
- "Cities that are not good profit prospects in the short term are turned over to third parties or dealers. The top 80 cities are reserved for Lexitron and have no dealers; third parties are used until the city is profitable."
- "Their dealers generally make money off service. They charge the same as Lexitron but have less overhead. They do not operate training, depots, etc. They also often carry other products and make more efficient use of the service people. Their margin on maintenance is 10-15%. Same as Indeserv."
- "Lexitron software has always come free with the equipment. They service it as part of the maintenance contract. Now they are moving into more DP related areas. The newest software is in records management. It is licensed separately and carries its own service fee. Lexitron hopes to develop this into a significant revenue source over time."
- "Decided that third party did not have enough at stake in the user and would not give this strong support. Instead they grew more slowly and contracted dealers to market the system. Dealers have both sales and service at stake so give better maintenance. Decision is made and the capital to establish field locations has been spent. Service is now a profit center though margin is very small. As they merge field support with Qyx and Quip, field maintenance will become more efficient and thus more profitable."
- "This equipment not best repaired remotely. With enough installed on-site, FE is cost effective. They will have RD capability in communicating machines to isolate the faulty unit and remove it from the network to avoid degrading

service. If involve user in maintenance, vendors must give better response, cheaper pricing, or better up time."

- "Indeserv takes a percentage of the user's maintenance contract (would not say how much). There is no penalty for very remote locations. They are ensured a reasonable profit on this arrangement.
- "Price/contract arrangements were great. If NBI needs service where Indeserv is not located, Indeserv will contract and guarantee a local service person to support it. This has been great, not like Sorbus which is inflexible."
- "NBI can discontinue any third-party contract on 30 days' notice should they want to support it themselves. NBI figures when they install 6-7 systems they can turn a profit. When they decide any location has the potential for 7 systems, they take the service in-house."
- "Users want the local guy, not some huge (TPM) company. Service would suffer since NBI would get low priority. If they only fixed NBI equipment five times a year they would forget how to anyway. They want a small vendor interested in their machines and their account."
- "Service is a profit/loss center at NBI. They are currently making a profit on the maintenance function but not a great deal." NBI refused to say how great the margin currently is.
- "We will not be using a major third-party organization. [They want service people with more interest in clients, such as dealers.]
- "The individuals now used cannot afford to buy spares, so Sveda provides them. A large third party would be expected to purchase spares just as dealers do."
- "Users want service from the manufacturer, not a third party or dealer. Both could be as good as Sveda. Sveda wants the service organization to have more

interest than just maintenance. They want sales/service and the hope of further sales as incentive for good service."

- "Maintenance at Sveda is not a profit/loss center."
- Reasons SHARP would consider TPM: "Greater control over the quality/quantity of service provided; less start-up costs."
- "Office products have been traditionally sold through dealers. Local people can sell local accounts much better than a national sales force. National accounts can be sold centrally but this would require national service coverage which would duplicate dealers. Dealers make money on sales and could be reluctant to service accounts which the OEM has stolen the sale on. Using a third party would be expensive and still duplicate/alternate local dealers. It is simply not worth it."
- "Savin is the only manufacturer to begin its own sales/service on a significant scale. Other vendors are trying to duplicate what Savin has done. Everyone sees that direct sales/support is more profitable than using dealers."
- "Dealers typically make a profit on maintenance. How efficient they are and how many machines are installed determine this. Dealers also make good money on the copier sale. However, the supplies are the key and continuous profit source. Users buy a machine, then come to the same dealer for supplies and service. The need for paper, tapes, etc., as well as other office products purchased at the same time is ongoing. The profit margin in these is tremendous."
- "Dealers will often try to make money on volume sales and cut the service fee to make it more attractive. Canon has suggested maintenance procedures and fees, but due to unconstitutionality of fair trade laws, cannot enforce them."
- "Have used (TPM) from time to time. Usually contract an independent FE in one of these remote places. Often he believes the dealer himself to make

more of a margin. They do not contract with large third parties because independents will do fine. Their objective is to get a new dealer established quickly, not make a long-range commitment to a third party."

- "Dealers typically make a profit on maintenance. The suggested service fees calculated on an average dealer will make money - not all will, but most should."

D. RESPONDENTS' COMMENTS ON TURNKEY SYSTEMS

- This part of the survey focused on CAD/CAM vendors.
- The method of market entry is direct sales and, in the main, direct field service. This is due to:
 - Need to keep the software safe from copy or outside knowledge.
 - Hardware makes up 25% or less of the sales price.
 - Hardware (except the CPU) is acquired from a number of different vendors.
- This is a rapidly growing market dominated by small firms that are hard pressed to keep up with the field service needs.

I. RESPONDENTS' COMMENTS

- "CAD/CAM systems composed of M&S terminals/work stations, DEC PDP-11/70 minicomputers (or VAX), Tektronix storage devices, Calcomp plotters, and Ampex disk drives. Seventy-five percent of revenues derived domestically, 25% from Canada, Europe and Latin America. Have approximately 250 systems installed in the U.S. All sold as packaged turnkey systems. Twenty-five percent of total revenue from sale of hardware."

- "Under no circumstances would field service or corporate management allow outsiders to repair the equipment. M&S provides no schematics to anyone. This CAD/CAM area is highly competitive and no chances can be taken. A third party would require training which would endanger their success. The software which drives the system is key, and they will not allow anyone (including the user) to tamper with it. Under such circumstances, using a third party is impossible. This will not change in the next five years."
- "A major vendor (as TPM) would be the worst. They would be most tempted to steal the technology and use it in their own CAD/CAM systems."
- "They (TPMs) cannot have the expertise in such a complex hardware/software system as do the in-house service people. Because the system uses a variety of equipment, they need special skills on each."
- "Combined hardware/software SSC for each of the five regions. The FEs are dispatched from these centers after discussing the problem with the user. There is some RD capability, but it is not currently used. They will begin using RD in connection with the SSC in the next year or so. Due to the systems complexity, on-site support will always be needed, so the number of FEs required will not change. They don't foresee using board swapping as FEs anywhere in the future."
- "Third-party service is not for high-technology areas, but rather for old, established equipment. No one is going to give data key to a company's success to a competitor just to get more service."
- "Currently have 50 FEs spread through the five regions. Maintenance is profitable in the metropolitan areas, but unprofitable in remote ones with little equipment installed. Maintenance is not a P/L center yet, though it is marginally profitable. Growth in the company has been so rapid that financials for service are misleading. They make money on the installations they service, but so much is then spent on training and establishing new FS locations that the end total does not look good."

- "Maintenance is concentrated in the major cities. When a remote location installs a system, they will service it from the city until it has enough systems to break even. Gerber guarantees 24-hour turnaround for service."
- Gerber's TPM arrangements are:
 - "Carterfone - they pay a fee based on the total number of users supported, regardless of location. Syntomics - they pay on a per-site basis with FE based on the particular characteristics and site of the installation."
- "Syntomics is the only good/big name (TPM) vendor in the area. Carterfone is a large distributor and would provide national service at a good price."
- "The TPM could have a better attitude with users. Service people are the only Gerber representatives after installation, and they should be very polite."
- "They also have backup support from Hewlett-Packard and Tektronix on their equipment. Both guarantee they will be on-site within eight hours when called. Gerber pays each on a T/M basis to do so. Gerber usually maintains the entire system. Both offer vendor and their own equipment."
- "Most users will still want on-site support. RD are currently being developed, and users will fix boards eventually if they want to. Third parties will be affected only if users in very remote areas choose to do their own maintenance."
- "Maintenance averages 5% of purchase price annually. More expensive systems are more elaborate and require better trained people - so more money. A \$500,000 machine required someone with 6-12 months' training. They feel competition forces low contract pricing overall - service is profitable."

E. RESPONDENTS' COMMENTS ON MICRO/MINICOMPUTER MARKET

- The micro market was covered in this section. (The mini market was addressed under turnkey and CAD/CAM.)
- The micro market is a non-issue as it relates to Honeywell TPM because:
 - The manufacturers enter the market via distributors and have no interest in TPM.
 - The maintenance fees gathered reflect a potential profit far below the established targets.
- It is a market to watch as it has huge potential, but due to its simplistic nature, it may never be profitable.

I. RESPONDENTS' COMMENTS

- "Zilog does not want to get tied into a third-party service contract. These offer local T/M maintenance only. Most users do their own repairs since the unit has only two boards. By not using a contract with third parties, Zilog can do exactly what is profitable."
- "Strictly T/M. Third parties charge varying rates, but Zilog assures one set fee. User pays Zilog, and Zilog pays third party. Zilog charges \$50 an hour and \$0.25 a mile, and most third parties charge less, so Zilog makes some money. Response is as available only, sometimes two weeks."
- "Zilog is EXXON owned. EXXON knows service is money and will not allow Zilog to give up this revenue source. As EXXON buys more companies, it will incorporate field groups to rival anything now existing. The EXXON office products field groups will be merged January 1, 1981 (Qyx, Vydec, Quip)."

- "Prefer to have user go to dealer (for service). They don't see any need to let this revenue escape Apple and its dealers. Apple sells parts at a profit to dealers as inventory for maintenance."
- "They (Apple) are looking at remote diagnostics and selling parts directly to users. This will not be decided for a year or so. If so, it would cut need for on-site maintenance, which is what third parties would be needed for."
- "Pay third party 75% of maintenance contract fees and they do all maintenance. Durango knows it will make a 25% margin. They can make this deal because the third parties get a big contract and the density is fairly good in most cities."
- Reasons Durango selected TPM:
 - "Did not have the money to establish a field force. Could not service where there were no dealers. Did not have enough equipment installed to cost justify establishing a field office. Wanted to immediately market nationally and needed some type of support. Are now adding two cities per month."
- "Sorbus, Comma and big companies were not flexible in their contracts and were too expensive. With Braegan and DJ, they to compromise their coverage some, but the price was right."
- "Third parties trap the vendor. Durango would like to start servicing the cities with many machines themselves. Since these are most profitable to the third-party, they refuse to allow it. Durango feels trapped into using a third party indefinitely. They can't afford to buy a field force all at once and see no other way if they terminate a third-party contract."
- "They feel the bigger the TPM, the more screwed up it becomes. They want to avoid forms, bureaucracy, etc. They want their equipment to get equal priority with all other."

F. RESPONDENTS

- The following is a list of the respondents showing interviews completed, interviews started but terminated by INPUT due to "not applicable", interviews where the proper party "refused" to talk about the subject, and interviews that were attempted and the proper person was "not available" or would not accept the call.
 - Interviews completed.
 - . Ampex (Misc.).
 - . Apple (Micro).
 - . Canon USA (Office).
 - . Compath (PABX).
 - . Durango Systems (Micro).
 - . Gerber Systems Technology (CAD/CAM).
 - . Hitachi America, Ltd. (PABX).
 - . Lanier (Office).
 - . Lexitron (Office).
 - . M&S Computing (CAD/CAM).
 - . MCI Telecommunications (Comm.).
 - . NBI (Office).

- . National CSS (Service Bureau).
- . OKI Electronics of America (PABX).
- . Satellite Business Systems (Comm.).
- . Scientific-Atlanta (Comm.).
- . Sharp Electronics (Office).
- . Sveda International (Office).
- . Vydec (Office).
- . Zilog (Micro).

- Interviewed - not applicable.

- . Cable and Wireless (Comm.).
- . Com Tech (Comm.).
- . Digital Telephone Systems (Comm.).
- . Kentron International (Comm.).
- . Telecom Library (PABX).

- Interviewee refused.

- . Autotrol (CAD/CAM).
- . Measurex (Turnkey Control Systems).
- . Minolta (Office).

- Rolm (PABX).
- Interviewee not available.
- Applicon (CAD/CAM).
- Computervision (CAD/CAM).
- Savin (Office).
- Tele/Resources (PABX).

